ZooKeys 82: 1–33 (2011)
doi: 10.3897/zookeys.82.715
www.zookeys.org

RESEARCH ARTICLE

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The scorpions of Yunnan (China): updated identification key, new record and redescriptions of *Euscorpiops kubani* and *E. shidian* (Arachnida, Scorpiones)

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Academic editor: *Jose Ochoa Camara* | Received 10 November 2010 | Accepted 3 February 2011 | Published 23 February 2011

Citation: Di Z, He Y, Wu Y, Cao Z, Liu H, Jiang D, Li W (2011) The scorpions of Yunnan (China): updated identification key, new record and redescriptions of *Euscorpiops kubani* and *E. shidian* (Arachnida, Scorpiones). ZooKeys 82: 1–33. doi: 10.3897/zookeys.82.715

Abstract

We present an identification key to the scorpion species of Yunnan (China) with notes on the distribution and ecology. *Euscorpiops kubani* is recorded for the first time for China. The redescriptions of *Euscorpiops shidian* and *E. kubani* are provided. The number of known scorpion species from Yunnan is raised to nine.

Keywords

Buthidae, Euscorpiidae, new record, taxonomy, redescriptions, Yunnan, China

Introduction

Yunnan province located in the junction of world's two major biodiversity hotspots (21°8'32"–29°15'8"N, 97°31'39"–106°11'47"E), is the transition area from the high altitudes of Qinghai-Tibet plateau to low altitude peninsular Malaysia. Almost all of the terrestrial ecosystems can be found in Yunnan, including forests, shrubs, meadows, swamps and deserts (Chen et al. 2010). Because of the complex and varied terrains and landforms, the different areas can be divided into seven zones according to different climate types: North tropics, South Subtropical, Central Subtropical, North Subtropical, South Temperate, Central Temperate and Plateau climate zones.

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The terrestrial diversity in Yunnan can meet the specific habitats demand of different species (Dong and Guo 2008). The scorpion biodiversity of the Yunnan is enormous compared to other provinces of China. Researchers erected six new species from the 1990s (Kovařík 1994, 2000; Qi et al. 2005; Di et al. 2010a, 2010b). The genus *Euscorpiops* Vachon, 1980 with its preference to humid habitats reaches its northern distribution limit in Yunnan, and the distribution of some species is restricted to this area.

There are nine species, belonging to two families: Buthidae: *Lychas* C.L. Koch, 1845, Euscorpiidae: *Euscorpiops* and *Scorpiops* Peters, 1861 have been recorded for this area. With seven species of *Euscorpiops* occur in Yunnan province more than a third of the total known species of this genus in the world (7/19); all them with similar coloration, morphology and close distribution.

Material and methods

Illustrations and measurements were produced using a Motic K-700L stereomicroscope with a drawing device and an ocular micrometer. The photos were taken with an Olympus C7070 camera. Measurements follow Sissom (1990), and are given in mm. Trichobothrial notations follow Vachon (1974) and morphological terminology mostly follows Hjelle (1990). Terminology of metasomal carination follows Vachon (1952), Prendini (2000) and Soleglad and Sissom (2001) for pedipalp chela carinae. Specimens are deposited in the Museum of Wuhan University, Wuhan, China (MWHU), and Biological specimens Herbarium of Dali College, Yunnan, China (BHDC). Other abbreviations of collections: FKCP: private collection of F. Kovařík, Prague, Czech Republic; MHBU: Museum of the College of Life Sciences, Hebei University, Baoding, China; MNHN: Muséum National d' Histoire Naturelle, Paris, France; NMPC: National Museum (Natural History), Prague, Czech Republic.

Taxonomy

Family Buthidae C.L. Koch, 1837
Genus *Lychas* C.L. Koch, 1845

Lychas mucronatus (Fabricius, 1798)
Figures 1–9

Scorpio mucronatus Fabricius 1798: 294.
Scorpio armillatus Gervais 1841: 284 (synonymized by Thorell 1888: 330).
Scorpio (*Androctonus*) *curvidigitatus* Gervais 1843: 129 (synonymized by Thorell 1893: 368).

Tityus varius C.L. Koch 1844 (synonymized by Thorell 1888: 330).
Isometrus chinensis Karsh 1879: 116 (synonymized by Kraepelin 1891: 81).
Isometrus atomarius Simon 1884: 363 (synonymized by Kraepelin 1891: 81).
Lychas baldasseronii Caporiaco 1947: 247 (synonymized by Kovařík 1997: 342).
Lychas mentaweius Roewer 1943: 212 (synonymized by Kovařík 1997: 342).
Lychas nucifer Basu 1964: 100 (synonymized by Kovařík 1997: 342).
Lychas mucronatus Pocock 1900: 36-37; Kovařík 1997: 341–344, Figs 10, 12, 29, 31, 80-82, 93, 98; Fet and Lowe 2000: 164, 165 [detailed reference list until 1998].

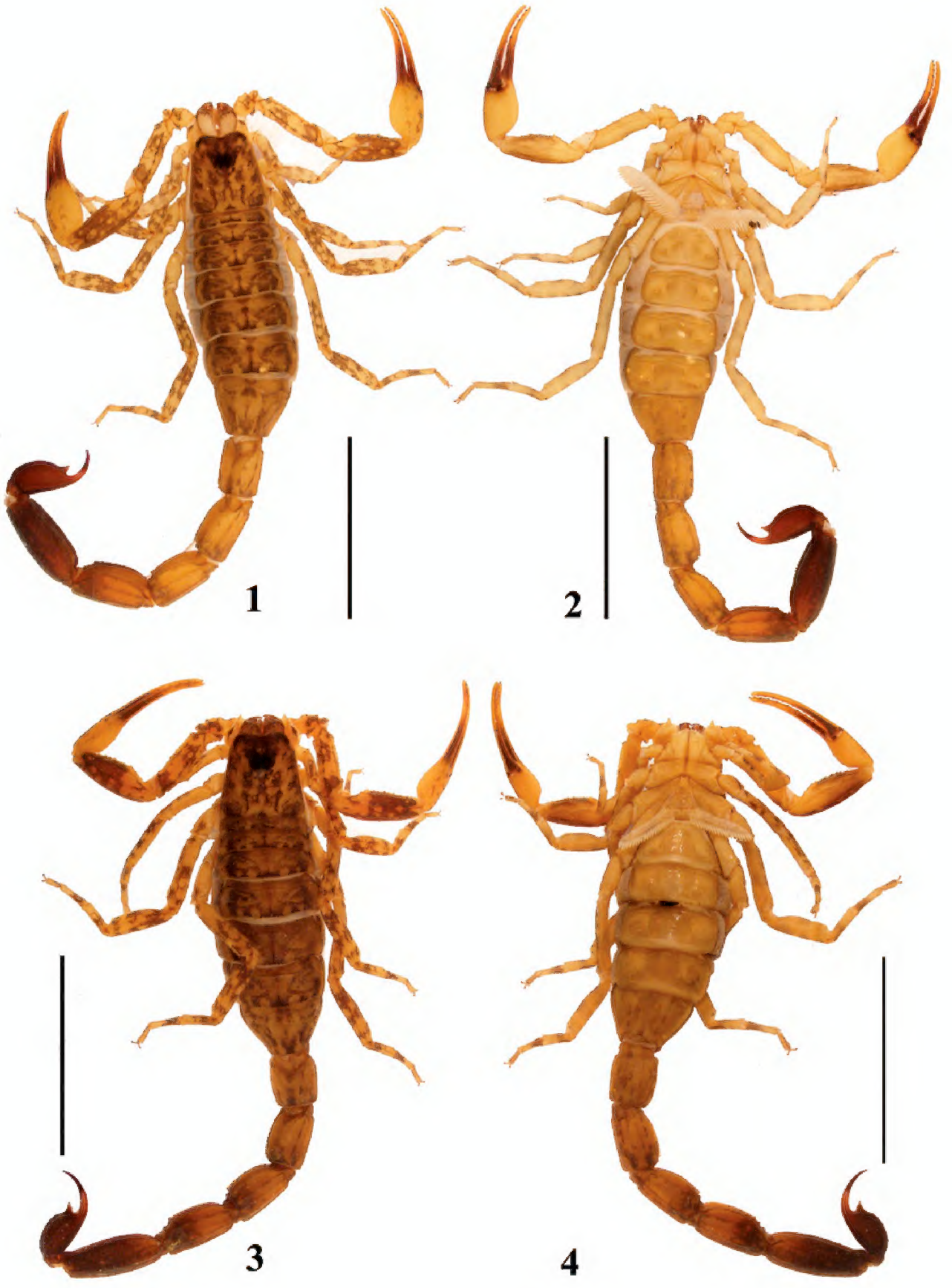
Type locality. India orientali, UZMD.

Type material. Lost.

Material examined. Shidian District, 17/VIII/2010, Dahe Jiang, Chaowu Yang and Zhiyong Di leg, 11 females, 3 males, 2 juveniles (MWHU, Ar.-MWHU-YNSD1010–15); Shidian District (24.42°N, 99.24°E), VIII/2008, Heng Xiao leg, 7 females, 7 males, 6 immatures (MWHU, Ar.-MWHU-YNSD0801–20); Longling District (24.47°N, 98.56°E), 18/VIII/2010, Wenxin Li, Hui Liu, Xiaohua He and Zizhong Yang leg, 14 females, 3 males, 4 juveniles (MWHU, Ar.-MWHU-YNLL1010–20); Gengma District, 6/VIII/2004, Zizhong Yang and Yuhua Yang leg, 2 males (BHDC, Ar.-BHDC-YNGM0401–02); Yun District, 21/VII/2003, Zizhong Yang and Benyong Mao leg, 2 males (BHDC, Ar.-BHDC-YNYX0301–02); Yongde District, 20/VII/2009, Benyong Mao leg, 1 female, 3 males (BHDC, Ar.-BHDC-YNYD0901–04); Mojiang District, Tongguan town, 22/XI/2010, Dongming Luo leg, 2 males, 5 females, 1 juvenile (MWHU, Ar.-MWHU -YNMJ1001–08).

Diagnosis. (Modified from Kovařík 1997). Total length about 40–65 mm in males and females (Figs 1–4). Male differs from female in having fingers of pedipalps proximally twisted (Fig. 5). Sixth cutting edge on movable and fixed fingers of pedipalps, usually with 3 external granules each (rarely 2 or 4 granules). First and second metasomal segments with 10 carinae, third and fourth segments with eight carinae. Ventral surface of seventh mesosomal segment with two carinae (not always discernible). Position and distribution of trichobothria on pedipalps as figures 5–9.

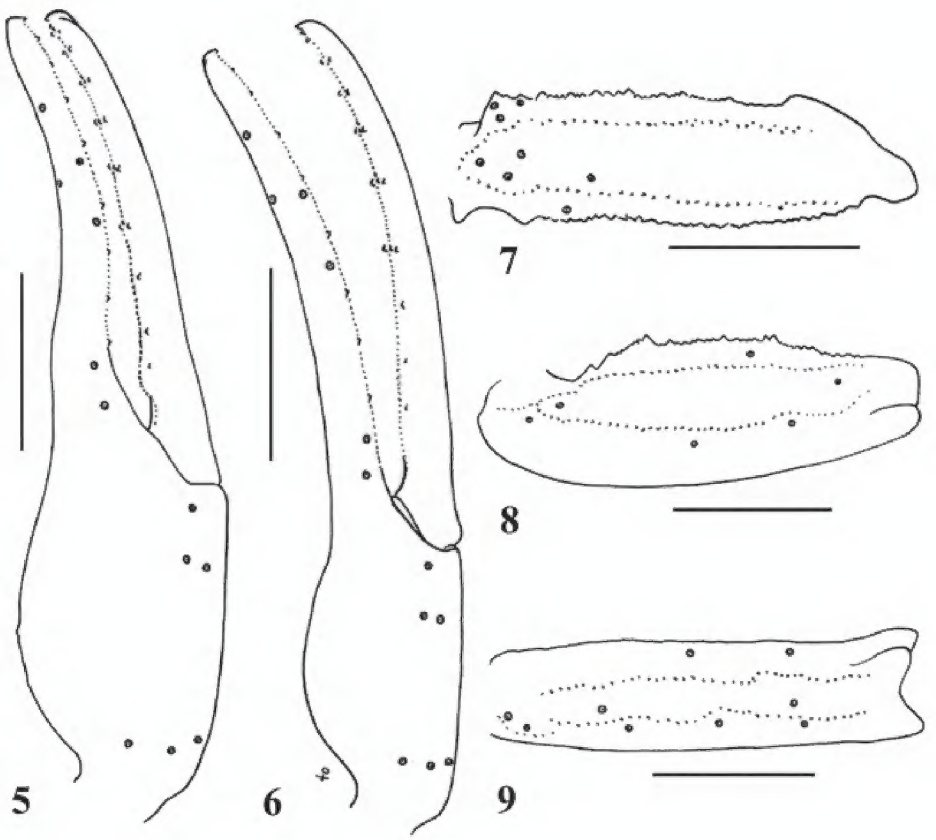
From its general morphology, *L. mucronatus* certainly related to *L. krali* Kovařík, 1995, described from Umphang River in Thailand. They have same important characters: second segment of metasoma with ten carinae, third metasomal segment with eight carinae; sixth cutting edge on movable fingers of pedipalps with two to four external granules; legs spotted. *L. mucronatus* can be distinguished from *L. krali* by the following characters: manus of pedipalps bright yellow with sparse, minute black spots, patella predominantly dark, compared with *L. krali*, in which the manus of pedipalps have the same color as patella and femur; pectinal teeth number 16–26, pectinal teeth 10–19 in *L. krali*; metasoma of approximately the same length in both sexes in *L. mucronatus*, whereas the metasoma much longer in males than in females in *L. krali* (Kovařík 1997: 360).



Figures 1–4. Habitus of *Lychas mucronatus*. **1–2** Male (Ar.-MWHU-YNSD1010), dorsal and ventral views **3–4** Female (Ar.-MWHU-YNSD1011), dorsal and ventral views. Scale bars: 12.0 mm.

Ecology. This species is common. We collected from mixed forest and buzzed canebrake. They are found in the bark, the gap of soil and under the stones.

Distribution. Cambodia, China (Guangxi, Hainan and Yunnan), India, Indonesia, Laos, Malaysia, Myanmar, Philippines, Thailand, and Vietnam (Kovařík 1997; Zhu, Qi and Song 2004).



Figures 5–9. 5, 7–9. *L. mucronatus*. Male (Ar.-MWHU-YNSD1010): **5** Chela, dorsal aspect **7** Femur dorsal aspect **8–9** Patella dorsal and external aspects. Scale bars: 2.0 mm. **6** *Lychas mucronatus*, female (Ar.-MWHU-YNSD1011). Chela, dorsal aspect. Scale bars: 2.0 mm.

Family Euscorpiidae Laurie, 1896
Subfamily Scorpiopinae Kraepelin, 1905
***Euscorpiops* Vachon, 1980**

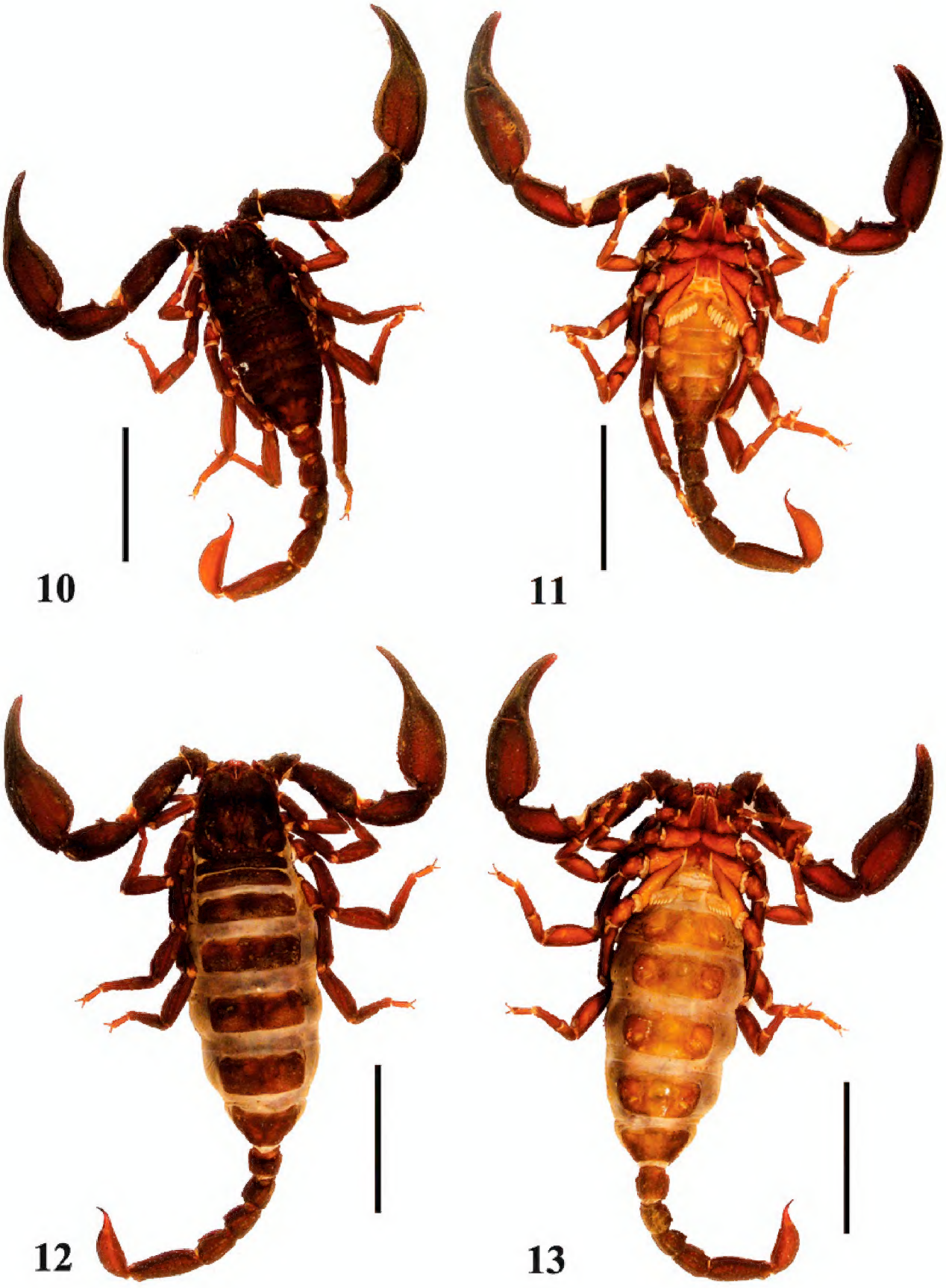
***Euscorpiops kubani* Kovařík, 2004, rec. n.**
Figures 10–28

Euscorpiops kubani Kovařík 2004: 13–18, Figs 1–6, tab. 1.
Euscorpiops kubani: Kovařík 2005: 1–10, Figs 1–6, tab. 1.

Type locality. Laos, prov. Phongsaly, Phongsaly env.

Type material. Holotype male, Laos, prov. Phongsaly, Phongsaly env., 21°41'2" N–102°06'8" E, 1500 m, Vt KubÆ leg, (deposited in the Moravian Museum, Brno, Czech Republic). Other type materials. Allotype female: Laos, prov. Phongsaly, Phongsaly env., 21°41'2" N–102°06'8" E, 1500 m, 28/V/20/VI/2003, leg. Vt KubÆ; (Moravian Museum, Brno, Czech Republic). 1 paratype male, Laos, prov. Phongsaly, Ban Sano Mai env., 21°21'N–102°03'E, ca 1150 m, 19. 26/V/2004, Vt KubÆ leg, (FKCP, followed Kovařík 2004).

Material examined. Menghai District (21.99°N,100.45°E), 21/VIII/2010, Wenxin Li, Xiaohua He, Hui Liu, Dahe Jiang and Zhiyong Di leg, 3 females, 3 males,



Figures 10–13. Habitus of *E. kubani*. **10–11** Male (Ar.-MWHU-YNMH1001), dorsal and ventral views **12–13** Female (Ar.-MWHU-YNMH1002), dorsal and ventral views. Scale bars: 12.0 mm.

3 female immatures, 2 male immatures (MWHU, Ar.-MWHU- YNMH 1001– 11); Menghai District, 21/VIII/2006, Bin Xu leg, 1 female immature (BHDC, Ar.-BH-DC- YNMH 0601–02).

Diagnosis. (Modified from Kovařík 2004) Adult 39–50 mm. Mainly color uniformly reddish-black. Pectinal teeth number 6–8. Sexual dimorphism expressed in

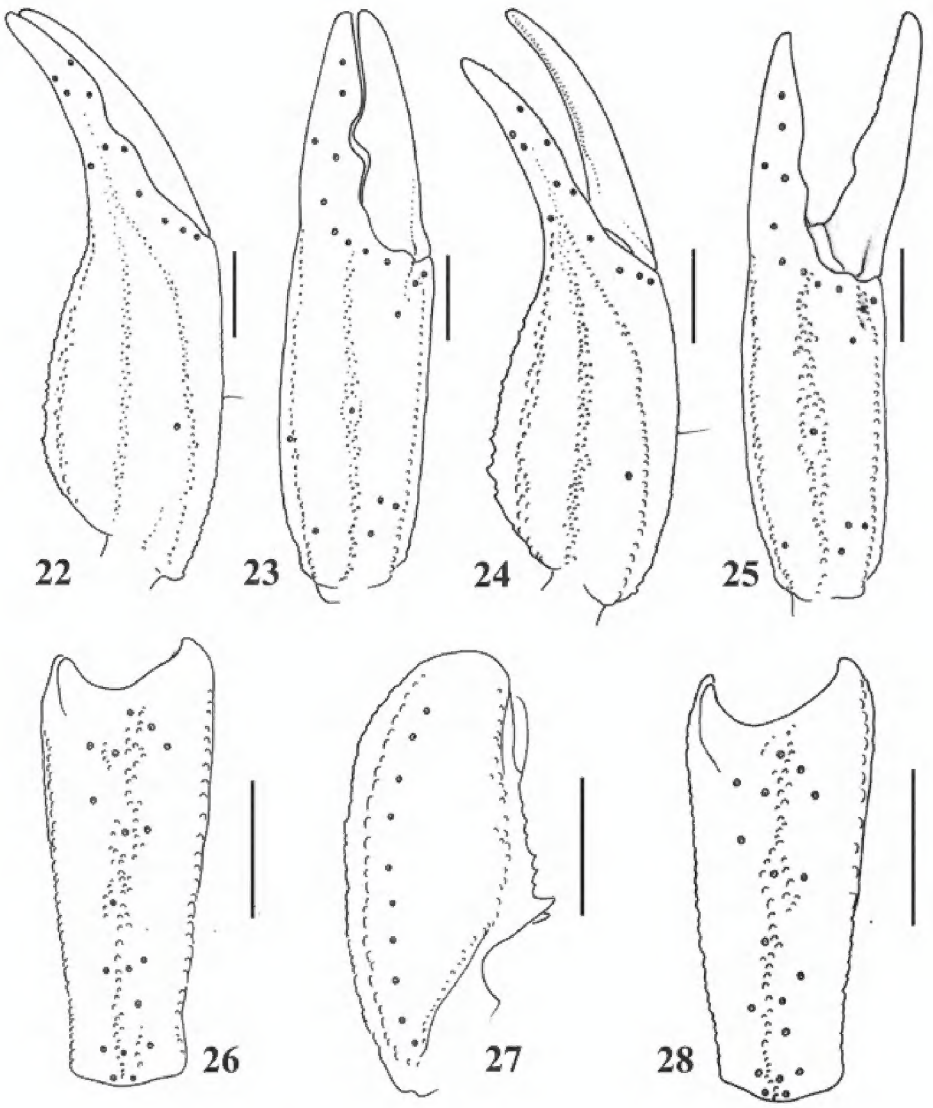
Figures 14–21. *Euscorpiops kubani*. **14–17** Male (Ar.-MWHU-YNMH1001). Chela dorsal, external, ventral and internal aspects **18–21** Female (Ar.-MWHU-YNMH1002). Chela dorsal, external, ventral and internal aspects. Scale bars: 6.0 mm.

shape of pedipalp fingers: in male flexed, in female nearly straight (slightly undulate). Pedipalp patella with 18 or rarely 19 external trichobothria (5 or 6 *eb*, 2 *esb*, 2 *em*, 4 *est*, 5 *et*) (Kovařík 2004), and 9 or 10 ventral trichobothria.

E. kubani is similar to *E. shidian* Qi, Zhu and Lourenço, 2005 in shape and color (Figs 10–13, 50–53): both are characterized by the presence of 18 trichobothria (*E. kubani*: mainly with 18) on the external surface of pedipalp patella, 6–8 pectinal teeth, chela with similar length/width ratio (Tab. 2). Both species can be separated by: male pedipalp chela fingers strongly scalloped in *E. kubani*, whereas in *E. shidian* males are slightly scalloped or straight, being the lobe and corresponding notch are reduced to absent; pectinal fulcra small, reduced or absent in *E. kubani*, but well developed in *E. shidian*.

Description (based on specimens: Ar.-MWHU-YNMH1001–02).

Coloration: Carapace dark red brown. Median and lateral ocular tubercles black. Tergites mostly dark red brown to dark brown. Metasoma segments dark red brown to dark brown. Vesicle red brown with a reddish aculeus. Chelicerae yellow brown



Figures 22–28. *Euscorpiops kubani*. **22–23** Male (Ar.-MWHU-YNMH1001): Chela dorsal and external aspects **26–27** Male (Ar.-MWHU-YNMH1001): Patella external and ventral aspects **24–25** Female (Ar.-MWHU-YNMH1002): Chela dorsal and external aspects **28** Female (Ar.-MWHU-YNMH1002): Patella external aspect. Scale bars: 2.0 mm.

with fingers dark red brown gradually lighter toward the tip. Pedipalp femur and patella dark red brown, chela manus and fingers red brown. Legs red brown with yellow brown tarsi. Tarsal ungues yellowish brown. Sternum, genital operculum and sternites pale brown. Pectines yellowish.

Morphology. *Prosoma*: Carapace with sparse, coarse granules; lateral furrow broad; anterior median furrow broad and moderately deep; posterior median furrow deep; margin behind lateral eyes with granules, other margins smooth. Median eyes situated anteriorly compared to center of carapace; three pairs of lateral ocelli, posterior smallest. Median ocular tubercle with granules and a pair of big median eyes and a median furrow. Lateral ocular tubercle with some granules around eyes.

Mesosoma: Tergites sparsely covered with coarse granules, posterior part of tergites with bigger granules; tergites II–VI with a median carina; tergite VII with two pairs of lateral carinae (with bigger granules). Pectinal teeth count 6–8, fulcra small reduced to absent. Genital operculum subtriangular. Sternites smooth and shiny; segment VII with 4 weak ventral carinae and few granules.

Metasoma: Tegument coarse. Segments II to V longer than wide; segments I to V with respectively 10-8-8-8-7 carinae, segments II–IV with a pair of vestigial lateral carinae; all dorsal carinae crenulate, slightly stronger distally; segment V carinae with smaller granules dorsally and larger serration ventrally. Vesicle with few setae and granules.

Pedipalps: Tegument coarse. Femur with external, dorsointernal, dorsoexternal, ventrointernal, ventroexternal and internal carinae granulated; tegument with scattered granules dorsally and smooth ventrally. Patella with dorsointernal, dorsoexternal, ventrointernal, ventroexternal and external carinae with big granules; two large spinoid granules present on the internal aspect; tegument with smooth granules dorsally and ventrally. Trichobothrial pattern C, neobothriotaxic (Vachon 1974); patella with 18 (rarely 19) external trichobothria (5 or 6 *eb*, 2 *esb*, 2 *em*, 4 *est*, 5 *et*) (Kovařík 2004), 10 or 9 ventral trichobothria (Fig. 27). Chela with length/width ratio: 2.7–3.0 in adult males and 2.7–2.9 in females (3.1 on male holotype, 3.2 on female paratype after Kovařík 2004). Chela with dorsal marginal, external secondary, and ventrointernal carinae granulated (Figs 14–21); ventrointernal carina with some big granules; tegument with granules forming reticulated pattern; male fingers scalloped with a pronounced lobe in the movable finger and a corresponding notch in fixed finger, lobe and corresponding notch reduced to absent in females (Figs 23, 25).

Chelicerae: Tegument smooth. Tibia smooth. Movable finger with 4 teeth on dorsal edge, 6–7 teeth (not constant) on ventral edge. Fixed finger with 3 teeth on dorsal edge.

Legs: Tegument coarsely granular dorsally, except basitarsi and telotarsi, smooth ventrally. Trochanters with few setae. Femur dorsal surface with few small granules, external surface with a granular carina, internal surface with two granular carinae. Patella internally with a dentate carina. Tibia with few setae and small granules, without spurs. Basitarsi with some spinules, few setae and 2 lateral pedal spurs. Tarsi ventrally with one row of short spinules and few setae. Tarsal ungues curved and hook-like.

Variation. Female and male paratypes: coloration and morphology are very similar to holotype (Kovařík 2004). Sexual dimorphism: adult males, with more pronounced lobes on the movable fingers of the chela, and a more pronounced notch in the fixed finger and bigger pectinal teeth than females. Measurements in table 1. Feature datasets in table 2.

Ecology. This species was collected from moist mixed forest and village. They are found in the shambles (brick or stones) and under the clod.

Distribution. China (Yunnan), Laos.

Euscorpiops puerensis Di, Wu, Cao, Xiao & Li, 2010

Figures 29–49

Euscorpiops puerensis Di et al. 2010: 49–61, Figs 1–34, tabs. 1–2.

Type locality. China, Yunnan, Puer.

Type materials, examined. Female holotype, China: Yunnan, Puer, X/2008, Heng Xiao leg, (Ar.-MWHU-YNPE0801); paratypes: 5 males and 4 females (including 2

Table 1. Measurements (in mm) of *Euscorpiops kubani* (Ar.-MWHU-YNMH1001 and Ar.-MWHU – YNMH 1002), *E. shidian* (Ar.-BHDC-YNSD0401 and Ar.-MWHU-YNSD1001) and *E. xui* (Ar.-BHDC- YNML 0901 and Ar.-BHDC- YNML0902).

	E. kubani		***E. shidian***		***E. xui***	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
Total length:	47.0	48.0	52.4	54.8	56.3	57.5
Carapace:						
-Length	7.6	7.1	7.9	8.3	8.4	9.2
-Anterior width	4.5	4.5	4.9	4.7	5.0	5.3
-Posterior width	7.7	7.5	9.0	8.7	8.9	8.3
Mesosomal segments: -Length	11.5	15.5	17.1	18.0	18.1	19.2
Metasomal segment I:						
-Length	2.5	2.9	3.0	3.0	3.1	3.0
-Width	2.9	2.8	3.0	3.1	3.3	3.4
-Depth	2.4	2.2	2.3	2.6	2.6	2.7
Metasomal segment II:						
-Length	3.0	3.0	3. 1	3.3	3.5	3.3
-Width	2.6	2.5	2.7	2.6	3.0	3.1
-Depth	2.2	2.0	2.3	2.3	2.7	2.5
Metasomal segment III :						
-Length	3.5	3.2	3.5	3.7	3.8	3.7
-Width	2.5	2.3	2.5	2.5	2.7	2.9
-Depth	2.2	2.2	2.4	2.3	2.5	2.5
Metasomal segment IV:						
-Length	4.3	3.4	3.8	4.3	4.3	4.3
-Width	2.4	2.2	2.4	2.2	2.5	2.6
-Depth	2.2	2.3	2.4	2.3	2.4	2.5
Metasomal segment V:						
-Length	6.9	5.9	6.5	7.0	6.7	7.0
-Width	2.3	2.2	2.2	2.2	2.4	2.5
-Depth	2.2	2.0	2.3	2.2	2.4	2.4
Telson:						
-Length	7.8	6.8	7.6	7.4	8.4	7.9
-Width	2.5	2.2	2.4	2.2	2.6	2.2
-Depth	2.2	1.8	2.2	2.0	2.5	2.2
Pedipalp femur:						
-Length	7.9	6.4	8.9	8.6	10.4	8.7
-Width	3.0	2.6	3.3	3.1	3.2	3.5
-Depth	2.4	2.3	2.5	2.6	2.7	2.8
Pedipalp patella:						
-Length	7.1	6.2	7.6	7.4	9.1	7.9
-Width	3.6	3.3	4.1	4.0	4.4	4.8
-Depth	2.9	2.7	2.9	2.9	3.2	3.3
Chela:						
-Length	14.5	13.5	16.0	16.5	19.5	17.0
-Width (manus)	4.6	4.4	4.7	4.7	4.7	5.3
-Depth (manus)	3.8	3.4	3.6	3.6	4.0	4.1
Movable finger:						
-Length	7.7	7.0	8.2	8.9	8.8	8.8
Pectinal teeth (L/R)	8/8	7/6	8/8	8/8	8/8	7/7

Table 2. Feature datasets of specimens of *Euscorpiops kubani*, *E. shidian* and *E. xui*. BL, body length; VTPP, ventral trichobothria of pedipalp patella (L/R); ETPP, external trichobothria of pedipalp patella (L/R); LWRC, length/width ratio of chela; PT, pectinal teeth; im, immature; HT, holotype; PT, paratype.

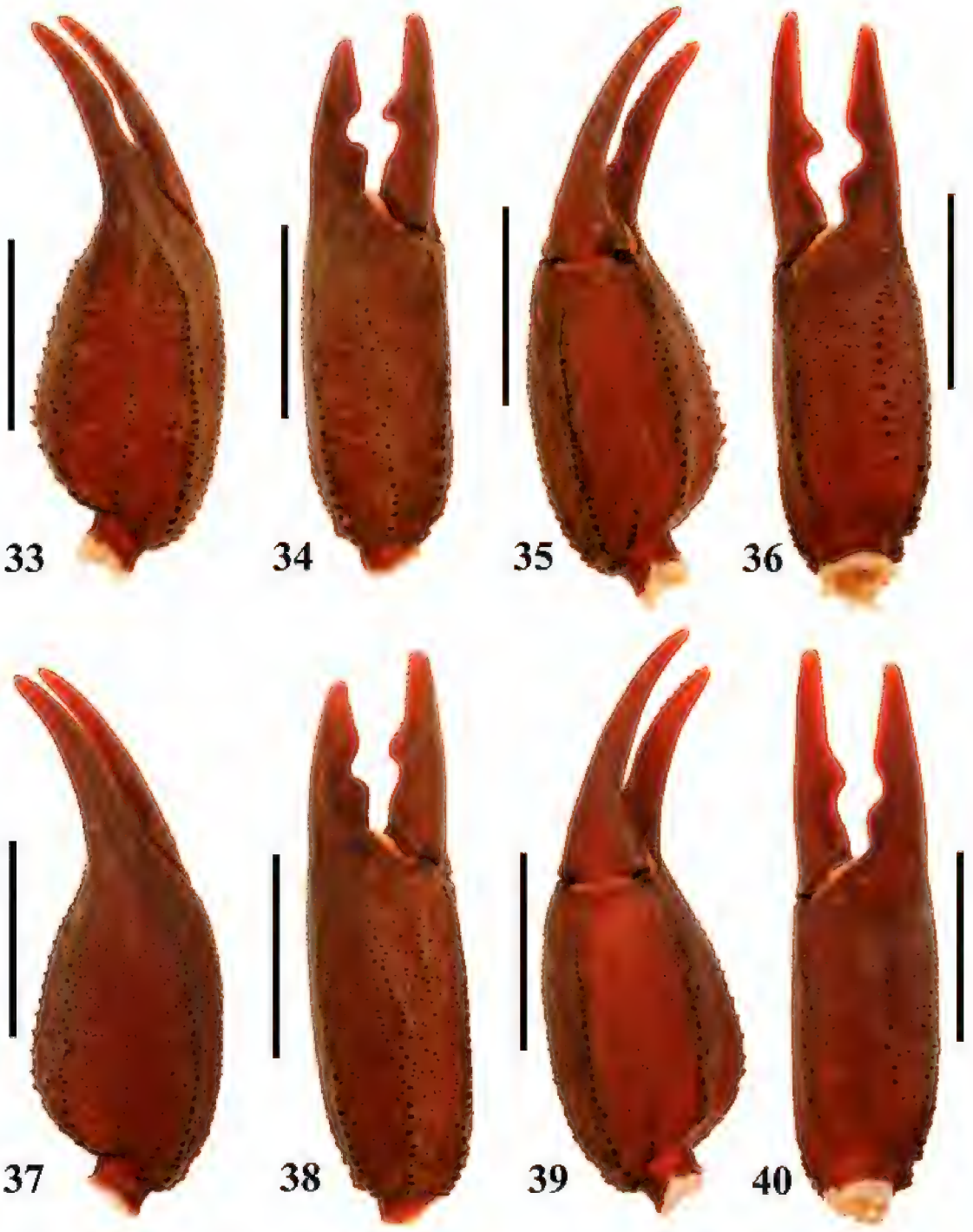
Species	Serial number	Sex	BL≈	VTPP	ETPP	PT	LWRC
E. kubani	HT(FKCP)	♂	39	10/10	19/19	8/8	3.1
	PT(FKCP)	♀	44	10/10	18/18	7/7	3.2
	Ar.-MWHU-YNMH1001	♂	47	10/10	18/18	8/8	3.2
	Ar.-MWHU-YNMH1002	♀	48	9/9	18/18	7/6	3.1
	Ar.-MWHU-YNMH1003	♂	48	10/10	18/18	8/8	3.1
	Ar.-MWHU-YNMH1004	♂	44	9/10	18/16†	6/7	2.9
	Ar.-MWHU-YNMH1005	♂im		10/10	18/18	7/7	
	Ar.-MWHU-YNMH1006	♂im		10/9	18/18	8/8	
	Ar.-MWHU-YNMH1007	♀	45	10/10	18/18	6/6	2.9
	Ar.-MWHU-YNMH1008	♀	44	9/10	18/18	7/6	2.7
	Ar.-MWHU-YNMH1009	♀im		9/10	18/18	7/6	
	Ar.-MWHU-YNMH1010	♀im		9/9	18/18	7/7	
	Ar.-MWHU-YNMH1011	♀im		10/10	18/18	6/6	
	Ar.-BHDC-YNMH0601	♀	45	9/10	17/17	6/6	2.7
	Ar.-BHDC-YNMH0601	♀im		11/11	18/18	6/6	
E. shidian	HT(MHBU)	♂	49	11/11	17/17§	7/7	1.6#
	PT(MHBU)	♂	60	11/11	17/17§	7/7	2.4#
	Ar.-BHDC-YNSD0401	♂	52	11/11	18/18	8/8	3.4
	Ar.-MWHU-YNSD1001	♀	55	10/11	18/18	8/8	3.5
	Ar.-MWHU-YNSD1002	♂	47	11/11	18/18	8/7	3.5
	Ar.-MWHU-YNSD1003	♂	50	11/11	18/18	8/8	3.3
	Ar.-MWHU-YNSD1004	♂im		11/11	18/18	8/8	
	Ar.-MWHU-YNSD1005	♀	50	12/12	18/18	6/6	3.2
	Ar.-MWHU-YNSD1006	♀	45	11/11	18/18	8/7	3.2
	Ar.-MWHU-YNSD1007	♀	45	11/11	18/18	6/7	3.5
	Ar.-MWHU-YNSD1008	♀	50	11/11	18/18	8/7	3.2
E. xui	HT(MHBU)	♀	66	10/10	19/19	7/7	3.6
	PT(MHBU)	♂	54	10/10	19/19	8/8	4.1
	Ar.-BHDC-YNML0901	♂	56	10/10	18/19	8/8	4.0
	Ar.-BHDC-YNML0902	♀	58	10/10	19/19	7/7	3.4

† It is visible that the right patella of pedipalp of this specimen (Ar.-MWHU-YNPMH1004) didn't developed well, in respect that with external trichobothria et_4 and est_2 absent (the position and terminology followed Kovařík 2000:157). § As these specimens came from the same village, it is very puzzling that with obvious external trichobothria difference. # Maybe there are different methods of measurement adopted by these authors lead to an enormous difference among length/width ratio of chela of type specimens and new material, however, it is obvious that they are with the same shape (Figs 50–61; Qi, Zhu and Lourenço 2005, Figs 78–83).

Figures 29–32. Habitus of *Euscorpiops puerensis*. **29–30** Male paratype (Ar.-MWHU-YNPE0805), dorsal and ventral views **31–32** Female holotype (Ar.-MWHU-YNPE0801), dorsal and ventral views. Scale bars: 12.0 mm.

male immatures and 1 female immature) (Ar.-MWHU-YNPE0802–06, Ar.-MWHU-YNPE0807–10), same data as holotype.

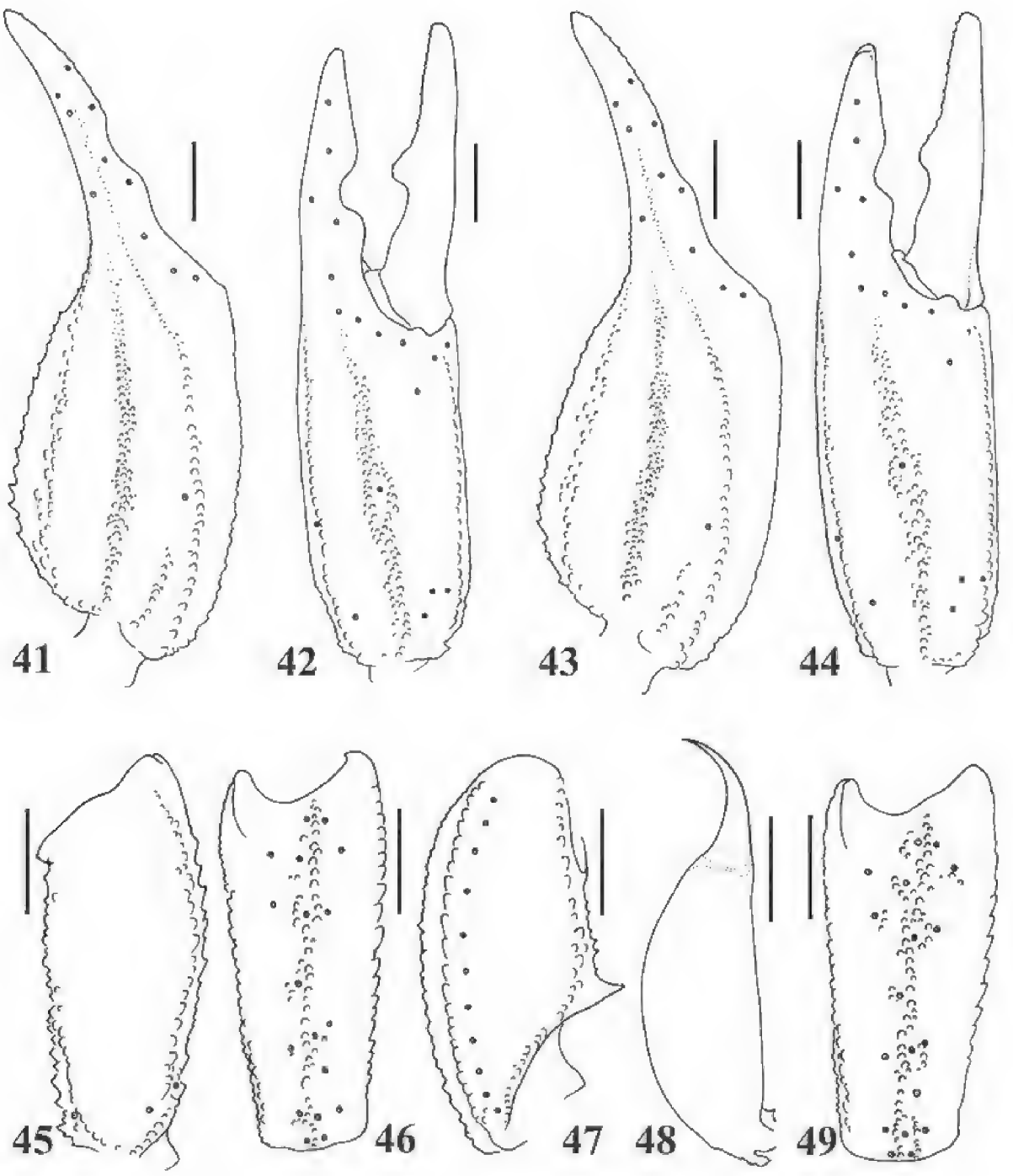
Diagnosis. *E. puerensis* differs from all other species in the genus on the basis of the following combination of characters: 18 external trichobothria (5 *eb*, 2 *esb*, 2 *em*, 4 *est*, 5 *et*), and 10 or 11 ventral trichobothria in the pedipalp patella (10 specimens); chela



Figures 33–40. *Euscorpiops puerensis*. **33–36** Male paratype (Ar.-MWHU-YNPE0805). Chela dorsal, external, ventral and internal aspects **37–40** Female holotype (Ar.-MWHU-YNPE0801). Chela dorsal, external, ventral and internal aspects. Scale bars: 6.0 mm.

with a length/width ratio average of 2.7 in males and females (5 males and 2 females); pedipalp chela fingers of adult females and males scalloped; pectinal teeth count 7–8; pectinal fulcra present.

E. puerensis appears to be closely related to *E. vachoni* Qi, Zhu and Lourenço, 2005: both are medium-sized scorpions characterized by the presence of 10 or 11 trichobothria on the ventral surface of pedipalp patella, a pronounced lobe on the movable finger and a corresponding notch on fixed finger of adult males, 7–8 pectinal teeth. The shape of the chela manus provides the most pronounced difference between them, in *E. puerensis* is flat dorsoventrally, whereas it is short, stout, and robust in *E. vachoni*. *E. puerensis* may be distinguished from *E. kubani* and *E. sejnai* Kovařík 2000



Figures 41–49. 41–42, 45–48 *Euscorpiops puerensis*. Male paratype (Ar.-MWHU-YNPE0805): **41–42** Chela dorsal and external aspects **45** Femur dorsal aspect **46–47** Patella external and ventral aspects **48** Telson, lateral aspect. Scale bars: 2.0 mm. **43–44, 49.** *E. puerensis*. Female holotype (Ar.-MWHU-YNPE0801): **43–44** Chela dorsal and external aspects **49** Patella external aspect. Scale bars: 2.0 mm.

by means of the following features: pedipalp chela fingers are distinctly scalloped on adult males and females in *E. puerensis*, whereas in *E. kubani* chela fingers are scalloped on male and nearly straight on female, and in *E. sejnai* male chela fingers are slightly scalloped (female unknown); 10–11 trichobothria on ventral surface of patella in *E. puerensis*, whereas there are 9 in *E. sejnai*, and 9–10 in *E. kubani* (11 rarely); chela with a length/width ratio average of 2.7 on males and females, whereas in *E. kubani* is higher than 2.7, and on *E. sejnai* is 2.75; 7–8 pectinal teeth, whereas there are 4–7 in *E. sejnai*, 6–8 in *E. kubani*; total length 48.8 to 60.0 mm in *E. puerensis*, whereas both *E. sejnai* and *E. kubani* are smaller than 48.0 mm (Kovařík 2000, 2004, 2005).

Description. See Di et al. (2010b).
Ecology. This species is found under the stones in mixed forest.
Distribution. China (Yunnan, just the type locality).

Euscorpiops shidian Qi, Zhu & Lourenço, 2005

Figures 50–68

Euscorpiops shidian Qi et al. 2005: 18, 22–25, Figs 78–93.

Type locality. China, Yunnan Province, Shidian District.

Type material. Holotype, male, Yunnan Province, Shidian District, Jiucheng town (24.43°N, 99.09°E), 15/VI/2004, Yingda Zhang and Zizhong Yang leg, (MHBU); paratypes: 1 female (MNHN), 2 females (MHBU), same data as holotype.

Material examined. Shidian District, Jiucheng town (24.43°N, 99.09°E), 16/VIII/2010, Dahe Jiang and Zhiyong Di leg, 5 females, 2 males, 1 male immature, 1 juvenile (MWHU, Ar.-MWHU-YNSD1001–09); Shidian District, Jiucheng town(24.43°N, 99.09°E), 15/VI/2004, Yingda Zhang and Zizhong Yang leg, 1 male, 1 juvenile (BHDC, Ar.-BHDC-YNSD0401–02), same data as holotype.

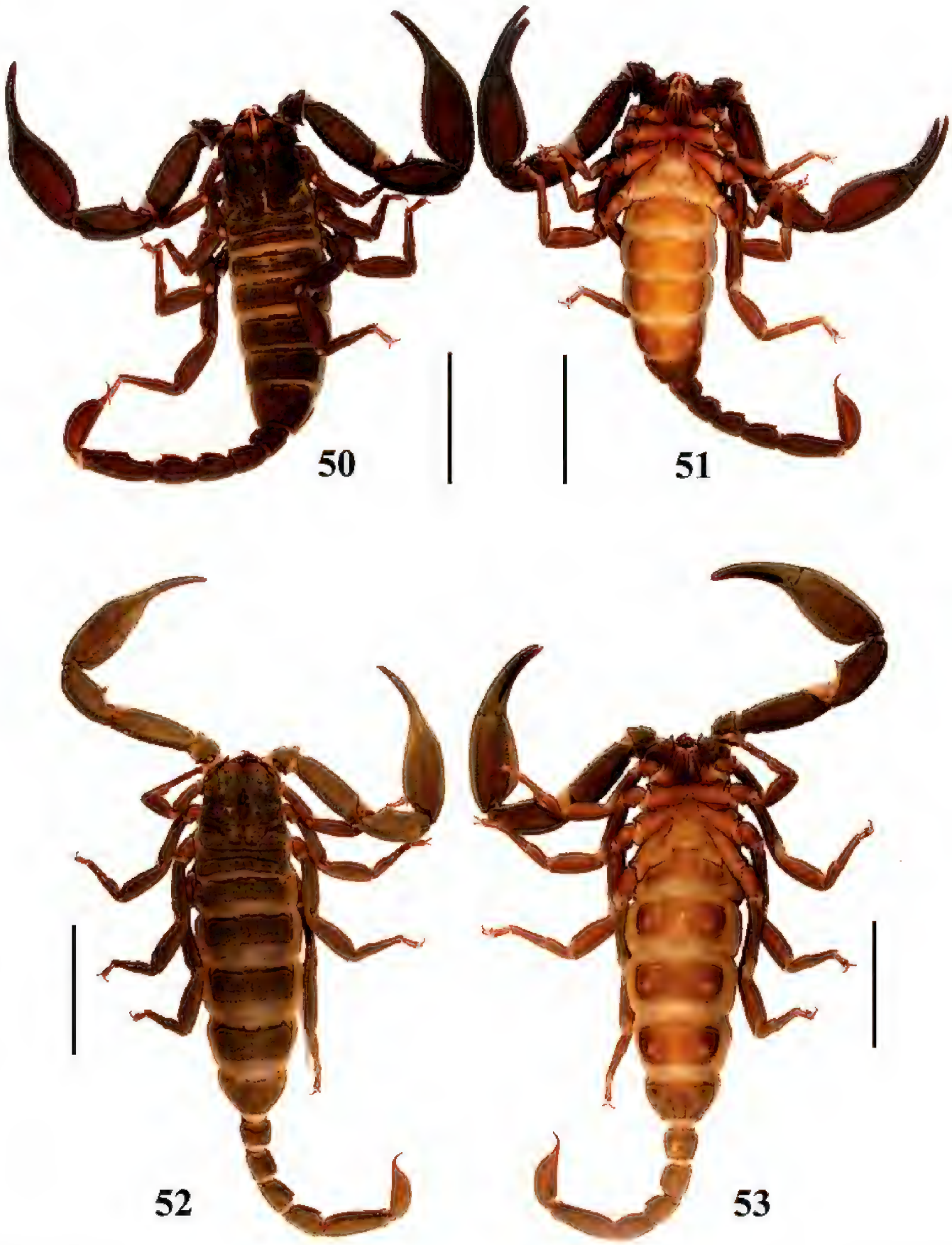
Diagnosis. *E. shidian* differs from all other species in the genus on the basis of the following combination of characters: pedipalp patella with 18 external (5 *eb*, 2 *esb*, 2 *em*, 4 *est*, 5 *et*), and 10–12 ventral trichobothria (rarely 10 or 12); chela with length/width ratio average of 3.3 (5 males and 5 females); inner surface of pedipalp chela fingers on adult females and males nearly straight; pectinal fulcra present (few and small).

E. shidian is morphologically most similar to *E. kubani*. Both species are characterized by the presence of 18 trichobothria (*E. kubani*: mainly with 18) on the external surface of pedipalp patella, 6–8 pectinal teeth, chela with similar length/width ratio (Tab. 2). They can be separated by: male pedipalp chela fingers slightly scalloped or straight in *E. shidian*, whereas in *E. kubani* males they are strongly scalloped; pectinal fulcra few but obvious in *E. shidian*, pectinal fulcra small reduced to absent in *E. kubani*.

E. shidian may be separated from *E. puerensis, E. vachoni and E. validus* Di, Cao, Wu and Li, 2010 on the basis of the following character: chela slender with a length/width ratio average of 3.3, whereas in *E. puerensis* chela with a length/width ratio average of 2.7, and in *E. vachoni* and *E. validus* chela smaller than 3.0; *E. shidian* may be separated from *E. yangi* Zhu, Zhang and Lourenço, 2007 and *E. xui* Sun and Zhu, 2010 by the following character: patella of pedipalp with 11 ventral trichobothria (rarely 10 and 12, Table 2), whereas on *E. yangi* with 9–10 (Zhu, Zhang and Lourenço 2007), on *E. xui* with 10 (4 specimens, Table 2); patella of pedipalp with 18 external trichobothria whereas on *E. xui* with 18–19.

Description (based on male (Ar.-BHDC-YNSD0401) and female (Ar.-MWHU-YNSD1001))**.**

Coloration: Carapace dark red black brown. Median and lateral ocular tubercles black. Tergites mostly dark red brown to dark brown. Metasoma segments dark red



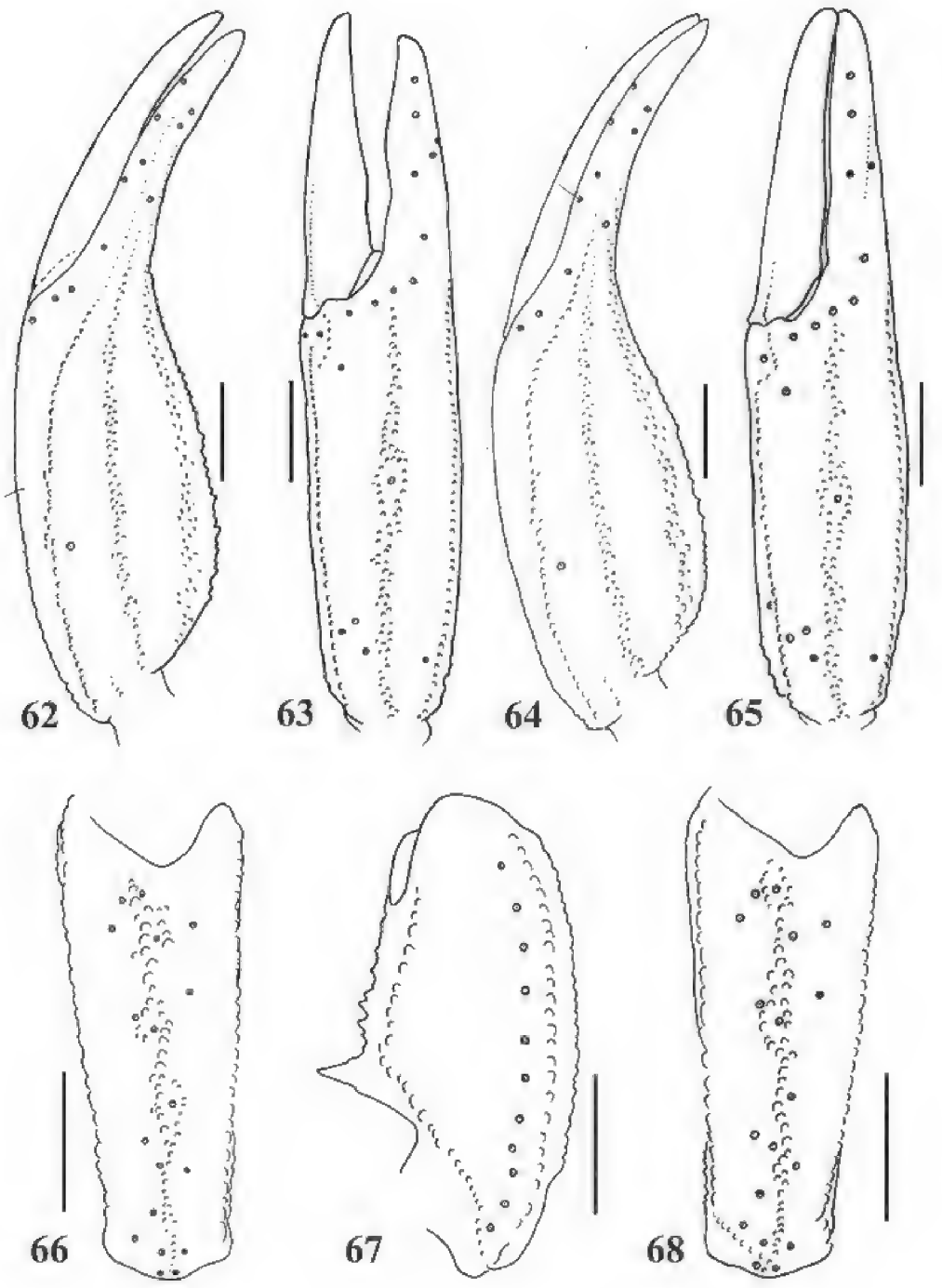
Figures 50–53. Habitus of *Euscorpiops shidian*. **50–51** Male (Ar.-BHDC-YNSD0401), dorsal and ventral views **52–53** Female (Ar.-MWHU-YNSD1001), dorsal and ventral views. Scale bars: 12.0 mm.

brown to dark brown; telson, vesicle brown, aculeus redish. Chelicerae yellow brown, fingers red brown gradually lighter toward the tip. Pedipalp femur and patella dark brown, chela manus and fingers dark red brown. Legs red brown with yellow brown tarsi. Tarsal ungues yellowish brown. Sternum, genital operculum and sternites brown. Pectines yellowish.

Figures 54–61. *Euscorpiops shidian* **54–57** Male (Ar.-BHDC-YNSD0401). Chela (left) dorsal, external, ventral and internal aspects **58–61** Female (Ar.-MWHU-YNSD1001). Chela (left) dorsal, external, ventral and internal aspects. Scale bars: 6.0 mm.

Morphology. *Prosoma*: Tegument coarse with fine and smooth granules. Carapace with sparse, fine granules; lateral furrow broad; anterior median furrow broad and moderately deep; posterior median furrow deep; margin behind lateral eyes with granules, other margins smooth. Median eyes situated anteriorly respect to the center of carapace; three pairs of lateral ocelli, posterior smallest. Median ocular tubercle coarse with granules and a pair of big median eyes and a median furrow. Lateral ocular tubercle with some granules around eyes.

Mesosoma: Tergites densely covered with fine granules, posterior part of tergites with bigger granules; tergite II to tergite VI with a median carina; tergite VII with two pairs of lateral carinae. Pectinal teeth count 6–8, fulcra small and obvious. Genital



Figures 62–68. 62–63, 66–67. *Euscorpiops shidian*. Male (Ar.-BHDC-YNSD0401): **62–63** Chela (left) dorsal and external aspects **66–67** Patella (left) external and ventral aspects. Scale bars: 2.0 mm **64–65, 68.** *E. shidian*. Female (Ar.-MWHU-YNSD1001) **64–65** Chela (left) dorsal and external aspects **68** Patella (left) external aspect. Scale bars: 2.0 mm.

operculum subtriangular. Sternites smooth; segment VII with four weak ventral carinae with granules.

Metasoma: Tegument coarse. Segments II to V longer than wide; segments I to V with respectively 10-8-8-8-7 carinae, segments II–IV with a pair of vestigial lateral carinae; dorsal carinae crenulated, slightly stronger distally; on segment V carinae with smaller granules dorsally and larger serration ventrally. Vesicle with sparse small granules, and few setae.

Pedipalps: Tegument coarse with fine and smooth granules. Femur with external, dorsointernal, dorsoexternal, ventrointernal, ventroexternal and internal carinae granulated;

tegument with scattered granules dorsally and smooth ventrally. Patella with dorsointernal, dorsoexternal, ventrointernal, ventroexternal and external carinae with big granules; two large spinoid granules present on the internal aspect; tegument with smooth granules dorsally and ventrally. Trichobothrial pattern C, neobothriotaxic (Vachon1974); patella with 18 external trichobothria (5*eb*, 2 *esb*, 2 *em*, 4 *est*, 5 *et*), 11 (rarely 10 and 12) ventral trichobothria (Fig. 67). Chela with a length/width ratio average of 3.3 on adult males and females. Chela with dorsal marginal, external secondary, and ventrointernal carinae granulated (Figs 54–61); ventrointernal carina with some big granules; tegument with small granules forming reticulated pattern; fingers nearly straight (Figs 63, 65).

Chelicerae: Tegument smooth. Tibiae smooth. Movable finger with 4 teeth on dorsal edge and 6–7 teeth (not constant) on ventral edge. Fixed finger with 3 teeth on dorsal edge.

Legs: Tegument coarse dorsally except basitarsi and telotarsi, smooth ventrally. Trochanters with few setae. Femur dorsal surface with some small granules, external surface with one granular carina, internal surface with two granular carinae. Patella internally with one dentate carina. Tibia with few setae and small granules, without spurs. Basitarsi with some spinules, few setae and two lateral pedal spurs. Tarsi ventrally with one row of short spinules and few setae. Tarsal ungues curved and hook-like.

Variation. Female and male paratypes: coloration and morphology are very similar to holotype (see Qi, Zhu and Lourenço 2005). Sexual dimorphism: the pectinal teeth of adult males are clearly bigger than those of adult females; this sexual dimorphism is common in *Euscorpiops* and *Scorpiops*. Measurements in table 1. Feature datasets in table 2.

Ecology. This species was collected from moist mixed forest and hamlets. They are found on the wall in the night and under stones in the day.

Distribution. China (Yunnan).

Euscorpiops vachoni Qi, Zhu & Lourenço, 2005

Figures 69–72

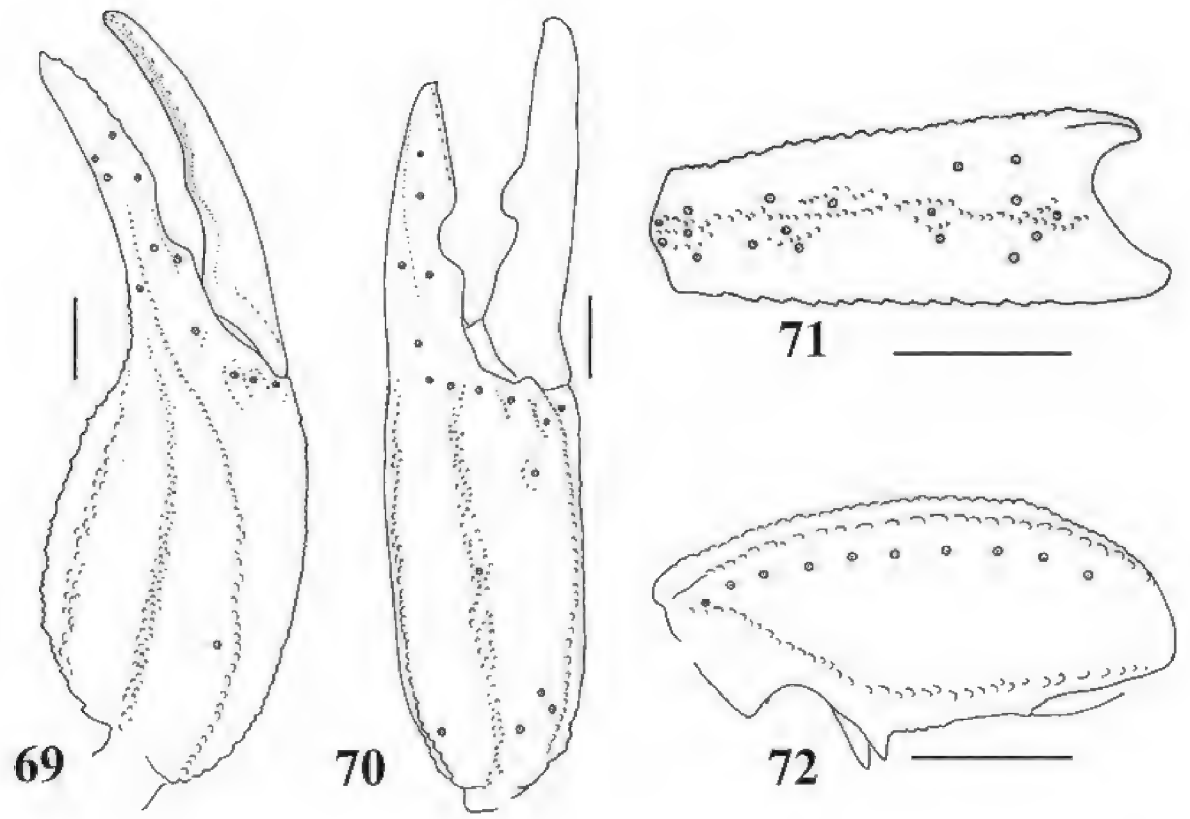
Euscorpiops vachoni Qi et al. 2005: 18–21, Figs 62–77.

Type locality. China, Yunnan Province, Mengla District.

Type material. Holotype male. Mengla district (21°29' N, 101°33' E), Yunnan Province, 2/VIII/2004, Zizhong Yang, Jing Li and Caixia Yuan leg, (MHBU); Paratypes: 1 female, same data as holotype (MHBU), 1 male, Tibet, Nyingchi district, 3/VIII/2003, Feng Zhang leg, (MNHN).

Material examined. Mengla District, 2/VIII/2004, Zizhong Yang, Jing Li and Caixia Yuan leg, 1 male immature, same data as holotype (BHDC, Ar.-BHDC-YNML0401).

Diagnosis. (Modified from Qi et al. 2005) *E. vachoni* differs from all other species of the genus on the basis of the following combination of characters: yellow brown



Figures 69–72. *Euscorpiops vachoni*. **69–70, 71** Holotype, male (MHBU, followed Qi, Zhu, and Lourenço 2005) **69–70** Chela dorsal and external aspects **71** Patella ventral aspect. Scale bars: 2.0 mm. **72** Male (immature, Ar.-BHDC-YNML1001). Patella external aspect. Scale bars: 2.0 mm.

color, 18 (17 in Qi et al. 2005) external trichobothria (5 *eb*, 2 *esb*, 2 *em*, 4 *est*, 5 *et*), and 10 ventral trichobothria in the pedipalp patella; adult chela manus stout and rounded (see Qi et al. 2005, Figs 63–66); pedipalp chela fingers on adult males scalloped; pectinal teeth: 7–8.

E. vachoni appears to be closely related to *E. puerensis*: both are medium-sized scorpions, characterized by the presence of 10 or 11 trichobothria on the ventral surface of pedipalp patella, a pronounced lobe on the movable finger and a corresponding notch on fixed finger of adult males, 7–8 pectinal teeth. The most pronounced difference between both species is: chela manus short, stout, and robust in *E. vachoni*, whereas it is flat dorsoventrally in *E. puerensis*.

E. vachoni may be separated from *E. shidian and E. yangi* on the basis of the following character: chela with a length/width ratio smaller than 3.0, whereas in *E. shidian* higher than 3.2, and in *E. yangi* 3.4 (males) and 3.3 (females). *E. vachoni* may be separated from *E. kubani* and *E. validus* by the following characters:yellow brown color in *E. vachoni*, compared with dark red brown in *E. kubani*, and dark brown inn *E. validus*; chela manus stout and rounded, whereas in *E. kubani* and *E. validus* flat. *E. vachoni* may be separated from *E. xui* by the following characters: patella of pedipalp with 18 external trichobothria whereas in *E. xui* with 18–19; chela with a length/width ratio smaller than 3.0, whereas in *E. xui* with a length/width ratio higher than 3.4.

Description. See Qi et al. (2005).

Ecology. This species is uncommon, type materials collected from moist mixed forest close to the border of China and Laos.

Distribution. China (Yunnan, just the type locality).

Notes. The immature male specimen checked bears 18/18 external trichobothria (5 *eb*, 2 *esb*, 2 *em*, 4 *est*, 5 *et*), and 10/10 ventral trichobothria in the pedipalp patella, 17 external trichobothria and 10 ventral trichobothria in the pedipalp patella on holotype (see Qi et al. 2005: 18).

Euscorpiops validus Di, Cao, Wu & Li, 2010

Figures 73–91

E. validus Di et al. 2010: 14–21, Figs 1–32, tabs. 1–2.

Type locality. China, Yunnan Province, Mengzi District.

Type material examed. Male holotype, China: Yunnan, Honghe Prefecture, 9/IX/2009, Junyun Huang leg (Ar.-MWHU-YNHH0901). Allotype female (Ar.-MWHU-YNHH0902); paratypes, 4 males, and 4 females (Ar.-MWHU-YNHH0903–06, Ar.-MWHU-YNHH0907–10), same data as holotype.

Diagnosis. Medium-sized scorpions, total length 50.0–59.8 mm. It can be distinguished from other species of *Euscorpiops* by having thicker chelas. It can be ditinguished from other *Euscopiops species* from Yunnan by the following features: pedipalp patella with 9 to 10 (rarely 11 or 8) ventral trichobothria; chela strong, length/width ratio: 2.9–3.2 (mean 3.0 in 3 males, and 3.1 in 4 females); pectinal fulcra present (obsolete in some females); chela fingers obviously curved; pectinal teeth: 7–8; pectinal fulcra present and small. *E. validus* can be ditinguished from related *Euscopiops* species by the following features: in *E. shidian* there are 11 (rarely 10 or 12) ventral trichobothria on pedipalp patella, chela length/width ratio higher than 3.2 in *E. shidian*, higher than 3.3 in *E.yangi* and higher than 3.4 in *E. xui*; chela fingers clearly curved in *E. validus*, whereas in *E. shidian* they are nearly straight, in *E. kubani* female nearly straight and in *E. yangi* they are slightly undulated in both sexes without sexual dimorphism; chela manus flat in *E. validus*, whereas in *E. vachoni* rounded.

Description. See Di et al. (2010a).

Ecology. This species is collected from moist mixed forest. They are found on the wall in the night and under stones in the day.

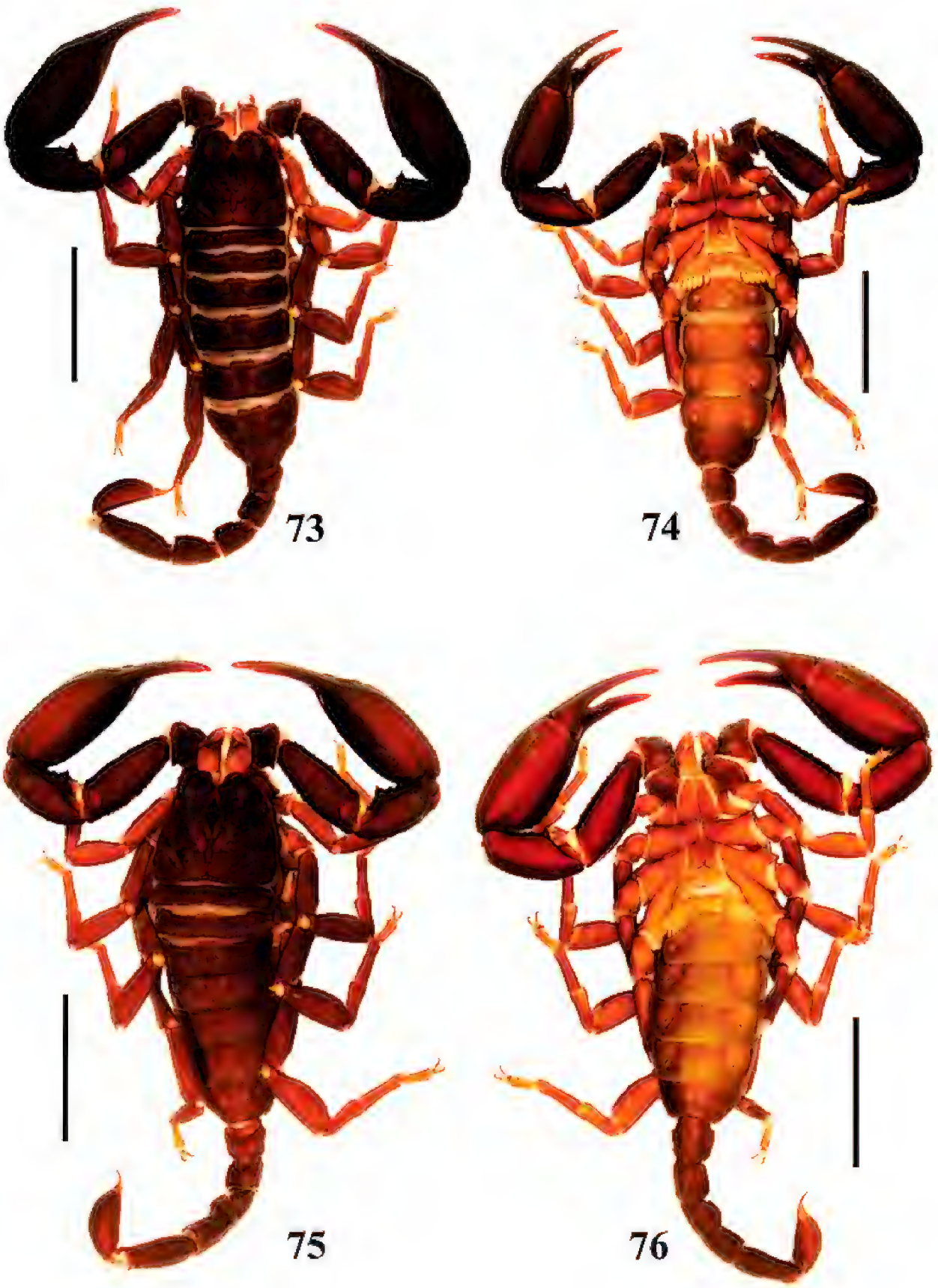
Distribution. China (Yunnan, just the type locality).

Euscorpiops xui Sun & Zhu, 2010

Figures 92–110

Euscorpiops xui Sun and Zhu 2010: 62–67, Figs 1–14, tab. 1.

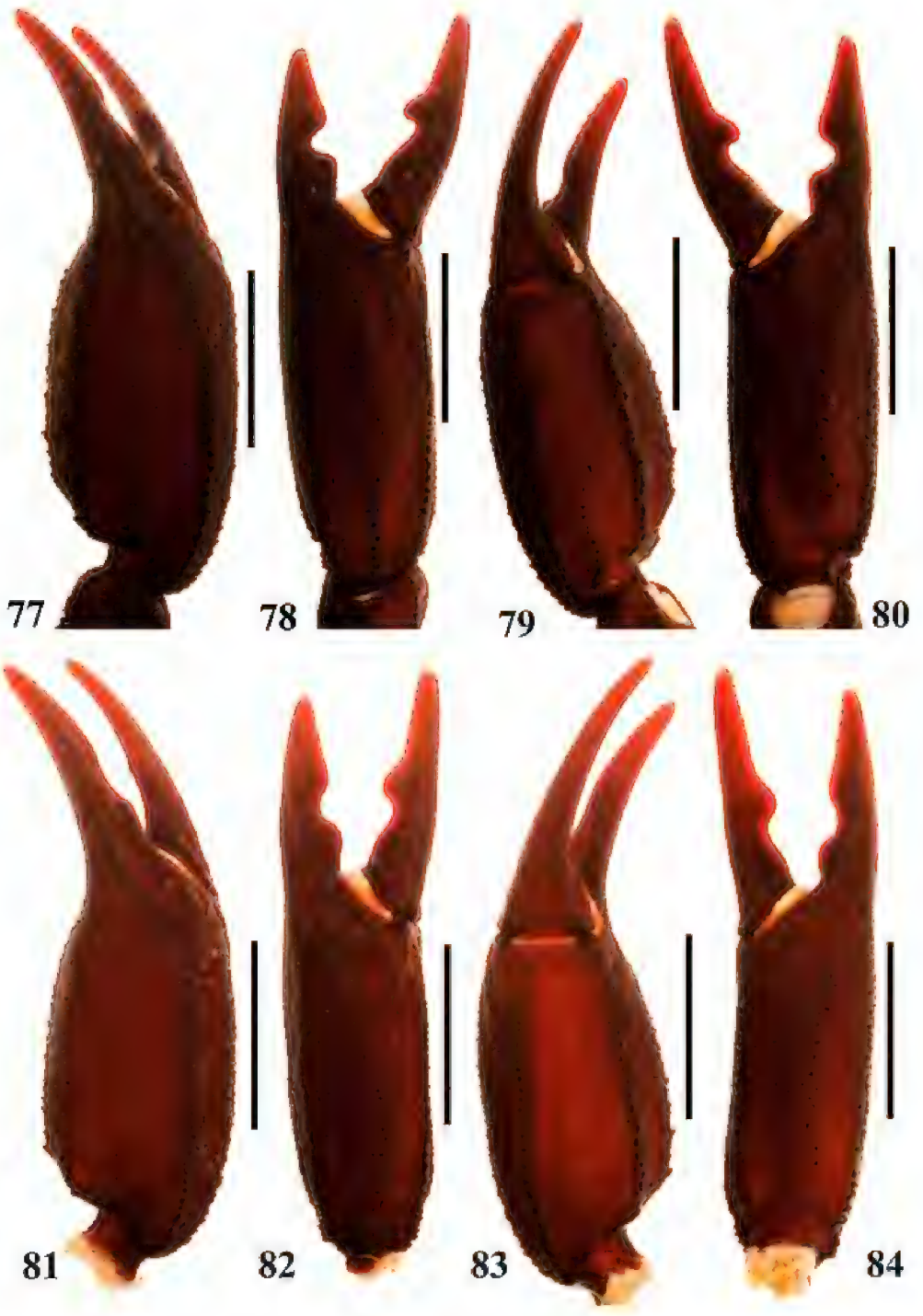
Type locality. China, Yunnan Province, Menglian District.



Figures 73–76. Habitus of *Euscorpiops validus*. **73–74** Male holotype (Ar.-MWHU-YNHH0901), dorsal and ventral views **75–76** Female allotype (Ar.-MWHU-YNHH0902), dorsal and ventral views. Scale bars: 12.0 mm.

Type material. Holotype female, China, Yunnan, Menglian District, Lafu Village, 22°08'N, 99°25'E, 15/VII/2009, Dr. Jishan Xu leg(MHBU); 1 female, 1 male, and 1 juvenile male paratypes, same data as holotype (MHBU).

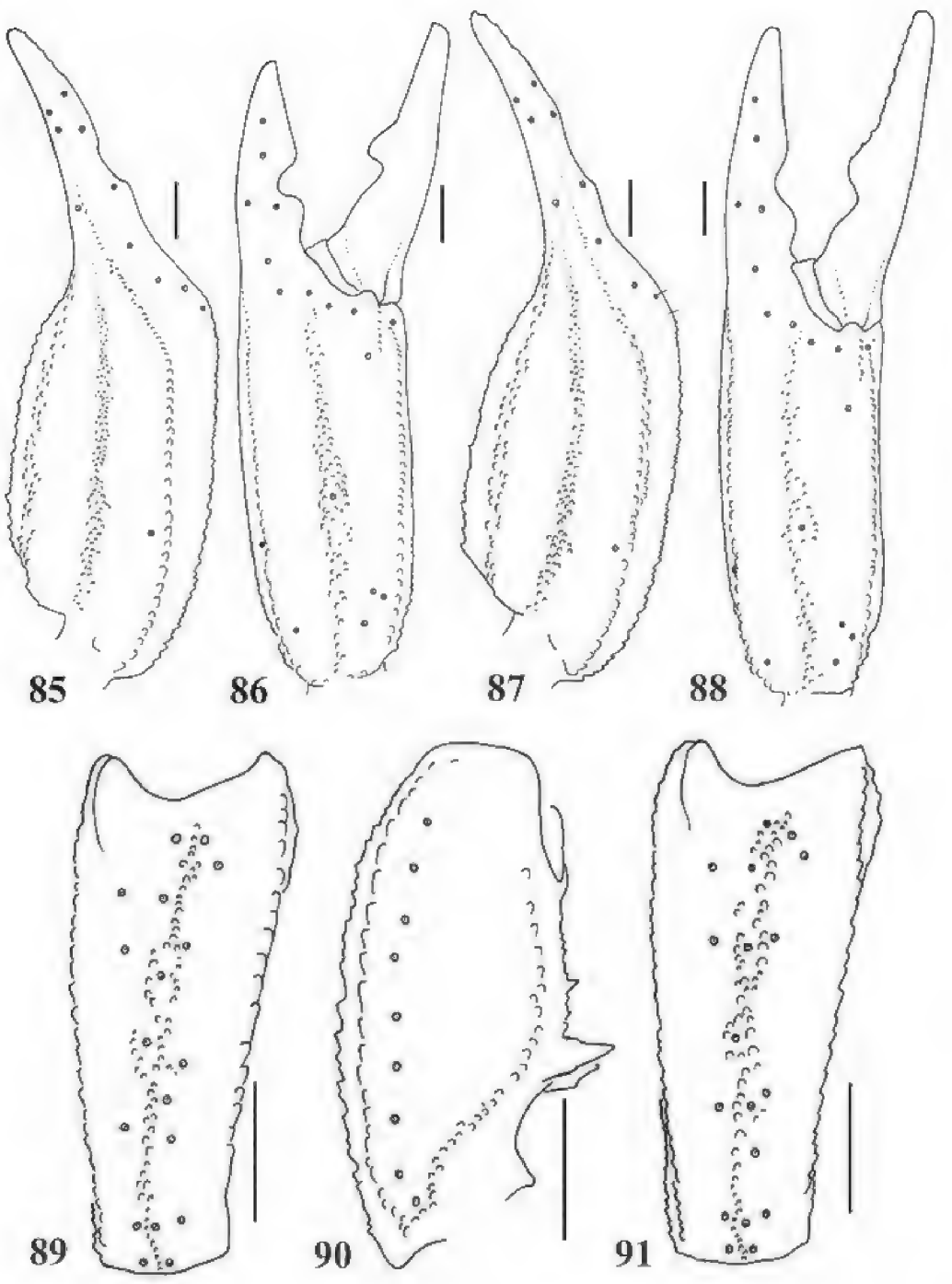
Material examined. Menglian County, 15/VII/2009, Lixiang Zhang leg, 1 male and 1 female. (BHDC).



Figures 77–84. *Euscorpiops validus*. **77–80** Male holotype (Ar.-MWHU-YNHH0901). Chela dorsal, external, ventral and internal aspects **81–84** Female allotype (Ar.-MWHU-YNHH0902). Chela dorsal, external, ventral and internal aspects. Scale bars: 6.0 mm.

Diagnosis (Modified from Sun and Zhu 2010)**.** total length about 54.0–66.0 mm (2 males and 2 females); color dark brownish-red; chela, length/width ratio about 3.5 in females (3.4 and 3.6 in 2 records) and about 4.0 in males (4.0 and 4.1 in 2 records); dentate margin with a slight lobe on movable finger and corresponding notch on fixed finger in both males and females; patella with 19 or 18 external trichobothria (5 *eb*, 2 *esb*, 2 *em*, 4 *est*, 5 or 6 *et* , fig. 108; 6 *eb*, 2 *esb*, 2 *em*, 4 *est*, 5 *et*, Sun and Zhu, 2010: fig. 3), and with 10 ventral trichobothria (4 specimens).

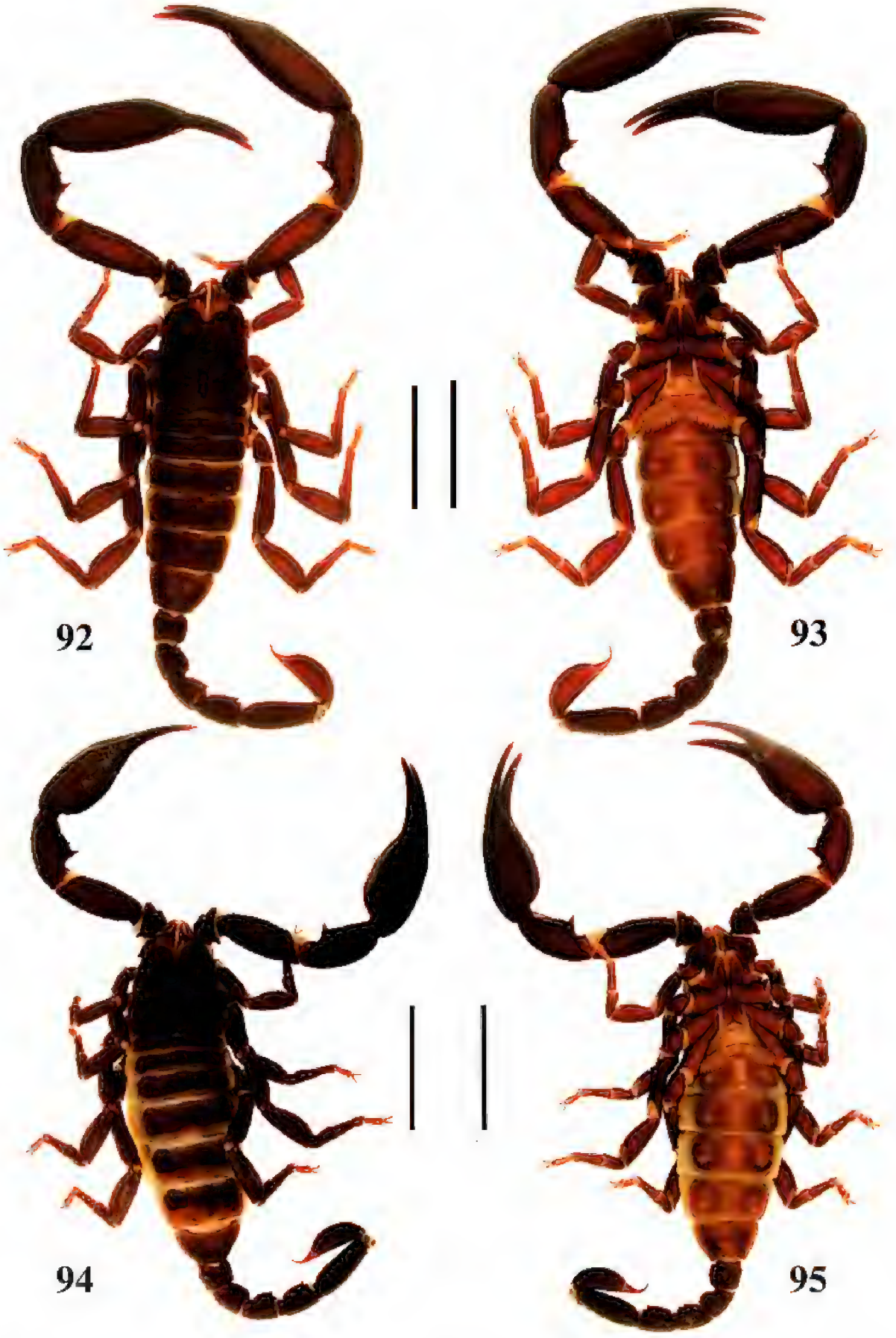
E. xui appears to be closely related to *E. kubani*, both can be distinguished by: male chela length/width ratio, about 4.0 in males and 3.5 in females, whereas it is about 3.1 in males and 2.9 in females in *E. kubani*; pedipalp fingers nearly straight (Figs



Figures 85–90. *Euscorpiops validus*. Male holotype (Ar.-MWHU-YNHH0901). **85–86** Chela dorsal and external aspects **89–90** Patella external and ventral aspects. Scale bars: 2.0 mm. **87–88, 91.** *Euscorpiops validus*. Female allotype (Ar.-MWHU-YNHH0902) **87–88** Chela dorsal and external aspects **91** Patella external aspect. Scale bars: 2.0 mm.

105, 107), while in *E. kubani* there is scalloped in males and nearly straight in females (Kovařík 2004; Sun and Zhu 2010).

E. xui can be distinguished from other related species of the genus *Euscorpiops* by the following features: patella of pedipalp with 10 ventral trichobothria, whereas in *E. shidian* with 11 (rarely 10 and 12); chela with a clear sexual dimorphism on length/width ratio: about 4.0 in males and 3.5 in females, compared with 2.7–3.2 in *E. kubani*, 2.9–3.2 in *E. validus*, and 2.6–2.8 in *E. puerensis*; patella of pedipalp with 18–19 (rarely 18) external trichobothria in *E. xui*, whereas 18 external trichobothria in *E. kubani*, *E. shidian*, *E. validus* and *E. yangi*; the coloration mainly dark brownish-red in *E. xui*, but yellow brown in *E. vachoni*.



Figures 92–95. Habitus of *Euscorpiops xui*. **92–93** Male (Ar.-BHDC-YNML0901), dorsal and ventral views **94–95** Female (Ar.-BHDC-YNML0902), dorsal and ventral views. Scale bars: 12.0 mm.

Description. See Sun and Zhu (2010).

Variation. Measurements in table 1. Feature datasets in table 2.

Ecology. This species is uncommon, collected from moist mixed forest close the villages.

Distribution. China (Yunnan).

Figures 96–103. *Euscorpiops xui*. **96–99** Male (Ar.-BHDC-YNML0901). Chela dorsal, external, ventral and internal aspects **100–103** Female (Ar.-BHDC-YNML0902). Chela dorsal, external, ventral and internal aspects. Scale bars: 6.0 mm.

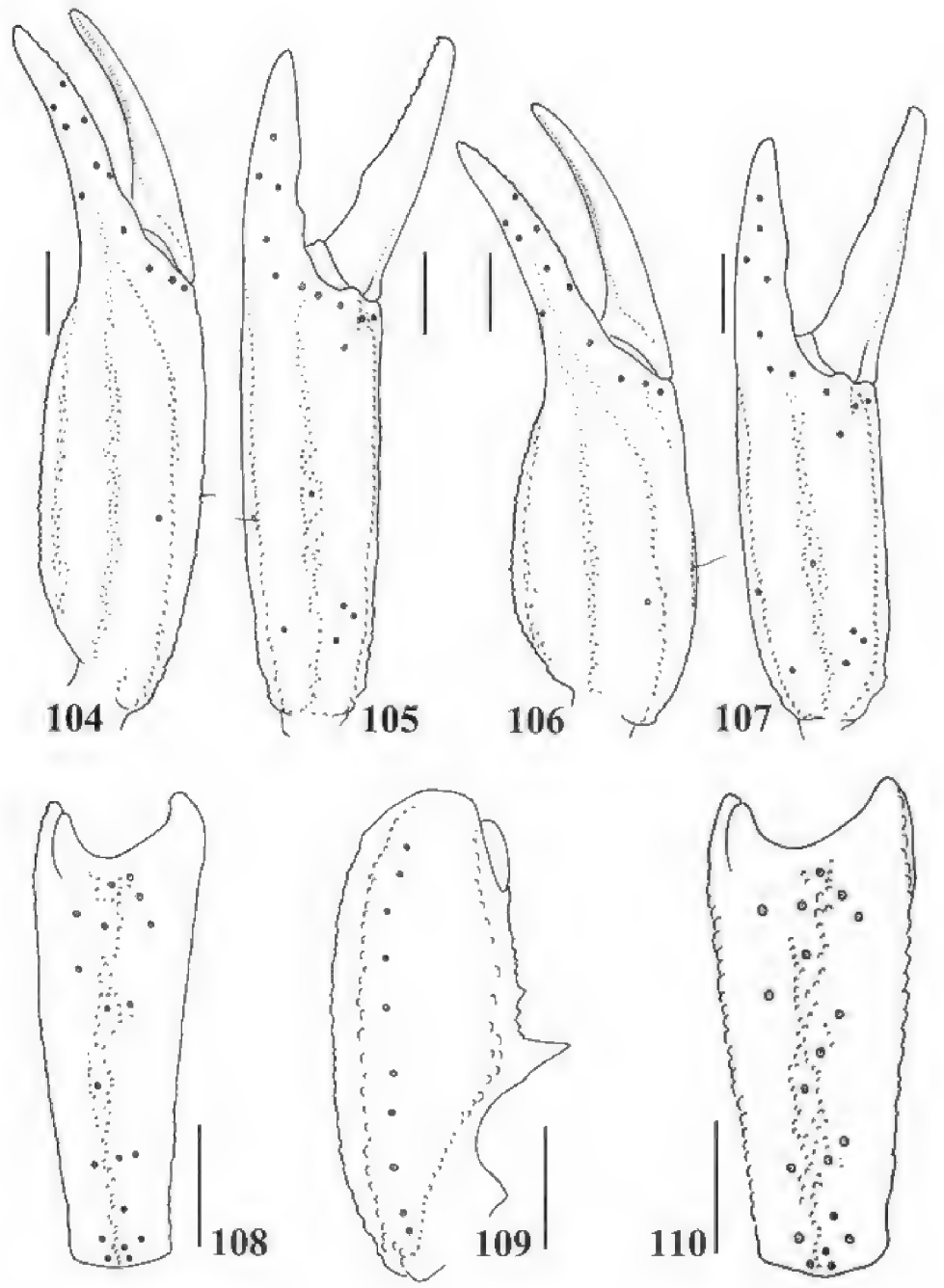
Euscorpiops yangi Zhu, Zhang & Lourenço, 2007

Figures 111–117

Euscorpiops yangi Zhu et al. 2007: 20–25, Figs 1–22, tab. 1.

Type locality. China, Yunnan Province, Maguan District.

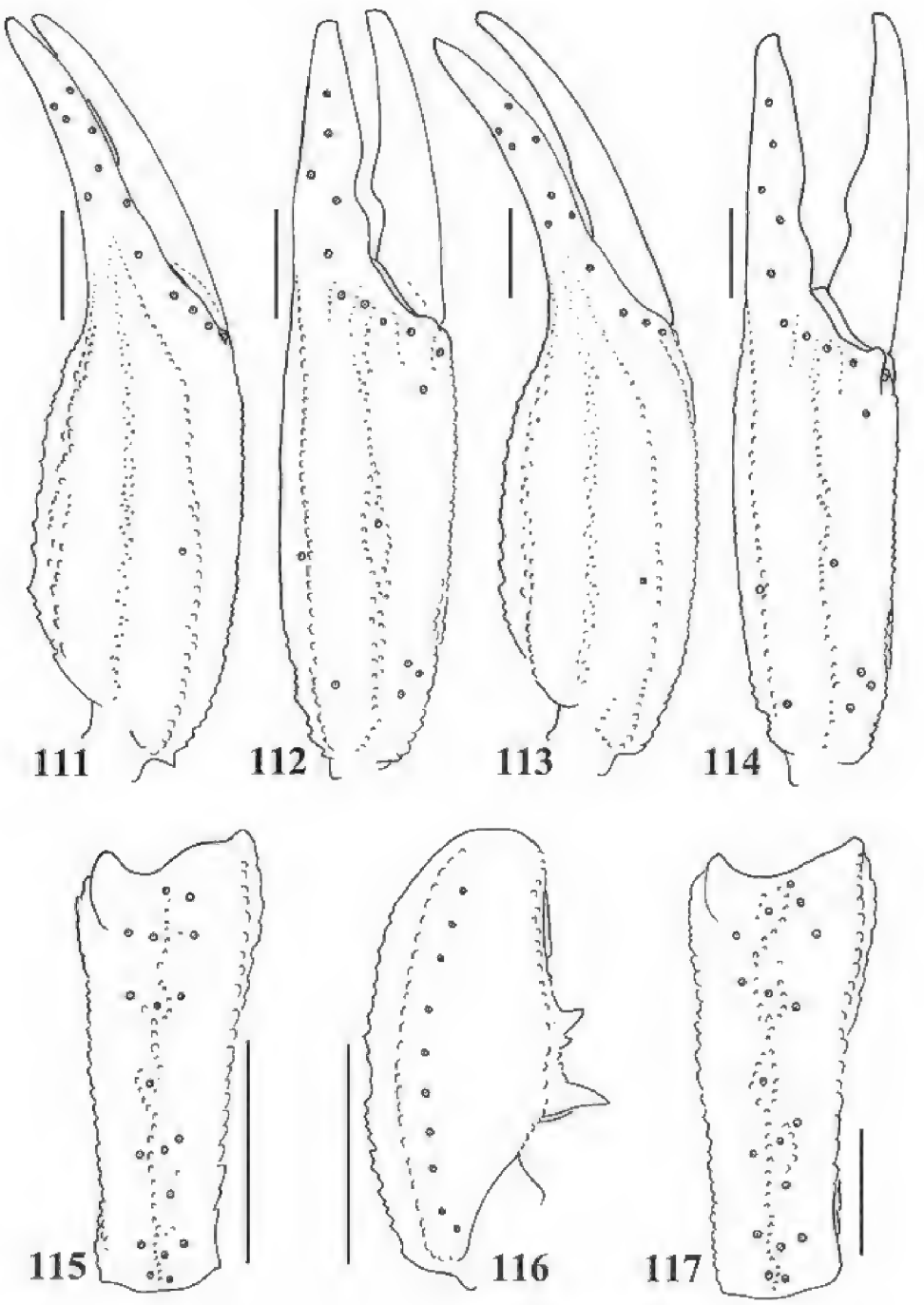
Type material. Male holotype, China, Yunnan Province, Maguan District, Gulingqing Town (23°00′N, 104°18′E), 20/VII/2006, Zizhong Yang and Yulong Wang leg, (Ar.-MHBU-0011); 3 males and 1 female paratypes, same data as holotype (1 male paratype in MNHN, the others in MHBU).



Figures 104–110. 104–105, 108–109. *Euscorpiops xui.* Male (Ar.-BHDC-YNML0901) **104–105** Chela dorsal and external aspects **108–109** Patella external and ventral aspects. Scale bars: 2.0 mm. **106–107, 110.** *E. xui.* Female (Ar.-BHDC-YNML0902) **106–107** Chela dorsal and external aspects **110** Patella external aspect. Scale bars: 2.0 mm.

Diagnosis. (Modified from Zhu et al. 2007) Medium-sized scorpion with total length 46.1 to 51.3 (4 males and 1 female); patella of pedipalp with 9 to 10 ventral trichobothria (Figs 115–117); chela narrow and elongated, the length/width ratio is 3.4 on males (4 specimens) and 3.3 on female (1 specimen), the chela length/carapace length ratio is equal or greater than 2.0; pedipalp fingers of males and females nearly straight (Figs 112, 114).

E. yangi can be distinguished from other related species of the genus *Euscorpiops* by the following features: patella of pedipalp with 9 to 10 ventral trichobothria, whereas



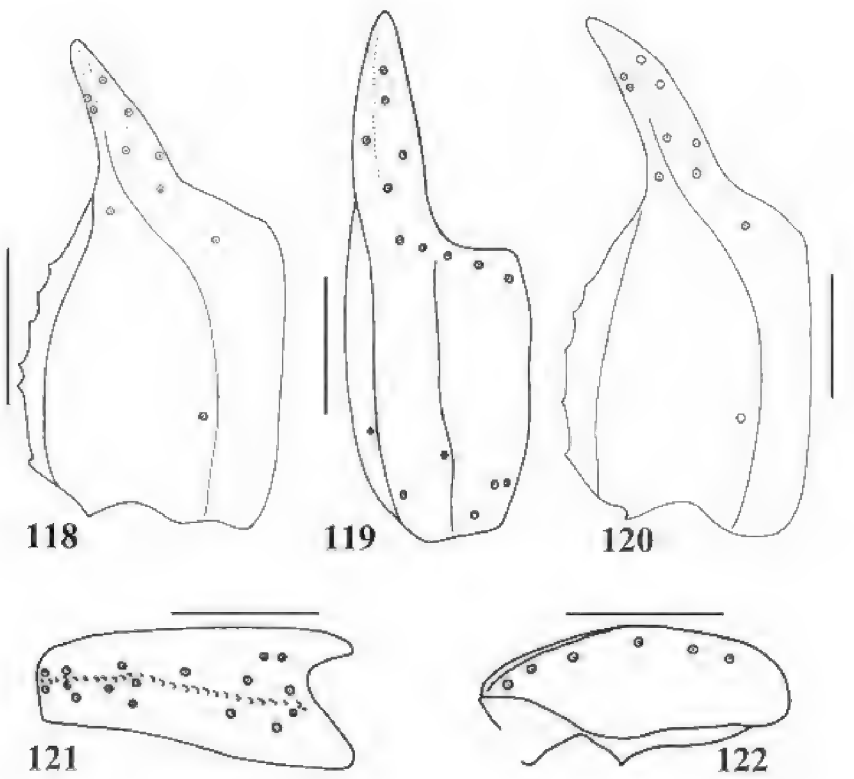
Figures 111–117. 111–112, 115–116. (followed Zhu, Zhang and Lourenço 2007). *Euscorpiops yangi*. Male holotype (Ar.-MHU-0011). **111–112** Chela dorsal and external aspects **115–116** Patella external and ventral aspects. Scale bars: 2.0 mm. **113–114, 117.** (followed Zhu, Zhang and Lourenço 2007). *E. yangi*, Female paratype **113–114** Chela dorsal and external aspects **117** Patella external aspect. Scale bars: 2.0 mm.

in *E. shidian* with 11 (rarely 10 or 12); chela narrow and elongated; the length/ width ratio is 3.4 in males and 3.3 in females, compared with 2.7–3.2 in *E. kubani*, 2.9–3.2 in *E. validus* , and 2.6–2.8 in *E. puerensis*. *E. yangi* can be ditinguished from *E. xui* by the following features: patella of pedipalp with 18 external trichobothria whereas in *E. xui* with 18–19; chela with length/width ratio 3.4 in males and 3.3 in females, whereas on *E. xui* with length/width ratio 4.0–4.1 in males (2 specimens) and 3.4–3.6 in females (2 specimens).

Description. See Zhu et al. (2007).

Ecology. This species is uncommon, found under stones.

Distribution. China (Yunnan).



Figures 118–122. *Scorpiops jendeki* (followed Kovařík 1994, 2000). Male holotype. **118–119** Chela dorsal and external aspects **121–122** Patella external and ventral aspecta. Scale bars: 2.0 mm. **120** *S. jendeki* (followed Kovařík 2000). Female. Chela dorsal aspect. Scale bars: 2.0 mm.

Genus *Scorpiops* Peters, 1861

***Scorpiops jendeki* Kovařík, 1994**
Figures 118–122

Scorpiops hardwickii jendeki Kovařík 1994: 62, Figs 7–13, tab.1; Fet, 2000: 492.
Scorpiops jendeki: Kovařík 2000: 180, 182, Figs 59–60, tabs. 1–3.

Type locality. China, Yunnan, Gaoligongshan Nature Reserve 100 km west of Baoshan.

Type material. Holotype female: China, Yunnan, Gaoligongshan Nature Reserve 100 km west of Baoshan; 1 female paratype (NMPC), 4 females paratypes (FKCP), 14–21/VI/1993, E. Jendek and O. Sausa leg.

Diagnosis. (Taken from Kovařík 2000). Total length is 30–42.1 mm. Patella with 17 external trichobothria (5*eb*, 2 *esb*, 2 *em*, 4 *est*, 4 *et*) (Fig. 121) and 6–7 ventral trichobothria (6 specimens, Fig. 122). Pectinal teeth 4–5. Both males and females have fingers of pedipalps straight, without any flexure. The carapace bears very sparse large granules.

S. jendeki appears to be closely related to *S. hardwickei* (Gervais, 1843), both species have the same number of external and ventral trichobothria on the patella, and a similar length/width ratio of chela; however, in the latter the fingers of pedipalps are strongly flexed.

Figure 123. Map of China (Yunnan), showing the localities of the Scorpiones species. Map abbreviations: square, *S. jendeki*; ellipse, *E. kubani*; heart, *E. puerensis*; triangle, *E. shidian*; polygon, *E. vachoni*; pentagon, *E. validus*; rhombus, *E. xui*; circle, *E. yangi*; red diagonal, *L. mucronatus*.

Description. See Kovařík (1994, 2000).

Ecology. This species is uncommon, collected from moist mixed forest and in the bark or leavers and moss.

Distribution. China (Yunnan).

Key to species of Scorpiones from Yunnan (China)

1 Anterior margin of carapace retuse (Figs 1, 3), 5 pairs of lateral ocelli; telson with a subaculear tubercle ..... ***L. mucronatus*** **(Fabricius)**

– Anterior margin of carapace deeply depressed (see Di et al. 2010b, Fig. 6), 3 pairs of lateral ocelli; telson without subaculear tubercle **2**

2 Trichobothrium Eb_3 on the external surface of the chela located between trichobothria *Dt* and *Db*, pedipalp chela fingers straight; telson without annular ring ..... ***S. jendeki*** **Kovařík**

– Trichobothrium Eb_3 on the external surface of the chela located between trichobothria *Dt* and *Est*; telson with an annular ring at the juncture of the vesicle with aculeus (Fig. 48) **3**

3 Male pedipalp chela fingers strongly scalloped: with a pronounced lobe on the movable finger and a corresponding notch on fixed finger **4**

– Male pedipalp chela fingers slightly scalloped or straight: lobe and corresponding notch reduced or absent **7**

4 Chela manus stout and rounded ..... ***E. vachoni* Qi, Zhu and Lourenço**

– Chela manus flattened dorsoventrally **5**

5 Female pedipalp chela fingers nearly straight..... ***E. kubani* Kovařík**

– Female pedipalp chela fingers scalloped..... **6**

6 Chela length/width ratio: 2.9–3.2 (average 3.0 in males, 3.1 in females); pedipalp patella with 9 to 10 (rarely 11 or 8) ventral trichobothria; pectinal teeth 6–8 (rarely 8) ..... ***E. validus* Di, Cao, Wu and Li**

– Chela length/width ratio: 2.6–2.8 (average 2.7 on both sexes); pedipalp patella with 11 or 10 (rarely 10) ventral trichobothria; pectinal teeth count 7–8 ..... ***E. puerensis* Di, Wu, Cao, Xiao and Li**

7 Chela length/width ratio about 3.5 in females, about 4.0 in males; platella of pedipalp with 19 external trichobothria (rarely 18) ..... ***E. xui* Sun and Zhu**

– Chela length/width ratio 3.2–3.5 in both sexes; patella of pedipalp always with 18 external trichobothria **8**

8 Number of trichobothria on ventral surface of patella: 11 (rarely 10 or 12), pedipalp chela fingers nearly straight (Figs 57, 61) .... ***E. shidian* Qi, Zhu and Lourenço**

– Number of trichobothria on ventral surface of patella: 10 or 9, pedipalp chela fingers slightly undulated (Figs 112, 114) ....*E. yangi* **Zhu, Zhang and Lourenço**

Acknowledgements

We are grateful to Prof. Heng Xiao, Prof. Xiaohua He, Dr. Zizhong Yang, Mr. Junyun Huang for collecting the specimens. Thanks are due to Prof. Victor Fet, Prof. Wilson R. Lourenço, Mr. František Kovařík, Mr. Michael Soleglad and Mr. Jan Ove Rein for providing references and valuable comments. Sincere appreciation goes to José A. Ochoa, Ivailo Stoyanov and two anonymous reviewers who provided valuable advices. We also thank Dr. Su Qiu, in particular, for linguistic improvement. This work was supported by grants from the National Natural Sciences Foundation of China (No. 30530140 & No. 31071942) to Wenxin LI, the Basic Project of Ministry of Science and Technology of China (No. 2007FY210800) to Wenxin LI, and the 973 program (No. 2010CB529800) to Yingliang WU.

References

Bastawade DB (1985) Scorpions (Arachnida). Records of Zoological Survey of India 82 (1–4): 259–262.

Bastawade DB (2006) Arachnida: Scorpionida, Uropygi, Schizomida and Oncopodid Opiliones (Chelicerata). Zool. Surv, India. Fauna of Arunachal Pradesh, State Fauna Series 13 (2): 449–465.

Chen Y, An K, Zhang H (2010) Biodiversity and outlook in Yunnan province. Shandong forestry science and technology 2: 100–103.

Di ZY, Zhu MS (2009) The male of *Euscorpiops karschi* (Scorpiones: Euscorpiidae, Scorpiopinae) from China (Xizang). Arthropoda Selecta 18(1–2): 9–16.

Di ZY, Cao ZJ, Wu YJ, Li WX (2010a) A new species of the genus *Euscorpiops* Vachon, 1980 (Scorpiones: Euscorpiidae, Scorpiopinae) from Yunnan, China. Zootaxa 2361: 13–22.

Di ZY, Wu YJ, Cao ZJ, Xiao H, Li WX (2010b) A catalogue of the genus *Euscorpiops* Vachon, 1980 (Scorpiones: Euscorpiidae, Scorpiopinae) from China, with description of a new species. Zootaxa 2477: 49–61.

Dong WG, Guo XG (2008) The Present Status and Conservation of Species Diversity in Yunnan Province. China Science and Technology Information 19: 21–23.

Fet V (2000) Family Scorpiopidae Kraepelin, 1905. In: Fet V, Sissom WD, Lowe G, Braunwalder ME (Eds) Catalog of the Scorpions of the World (1758–1998). The New York Entomological Society, New York, 487–495.

Fet V, Lowe G (2000) Family Buthidae C. L. Koch, 1837. In: Fet V, Sissom WD, Lowe G, Braunwalder ME (Eds) Catalog of the Scorpions of the World (1758–1998). The New York Entomological Society, New York, 54–286.

Hjelle JT (1990) Anatomy and morphology. In: Polis GA (Ed) The Biology of Scorpions. Stanford University Press, Stanford, 9–63.

Kovařík F (1994) *Scorpiops irenae* sp. n. from Nepal and *Scorpiops hardwickei jendeki* subsp. n. from Yunnan, China (Arachnida: Scorpionida: Vaejovidae). Acta Societatis Zoologicae Bohemoslovenicae 58 (1–2): 61–66.

Kovařík F (1997) Revision of the genera *Lychas* and *Hemilychas*, with descriptions of six new species (Scorpiones, Buthidae). Acta Societatis Zoologicae Bohemoslovenicae 61: 311–371.

Kovařík F (1998) Štiři (Scorpions). Nakladatelstvi Magagaskar, Jihlava, 175 pp. [in Czech]

Kovařík F (2000) Revision of family Scorpiopidae (Scorpiones), with descriptions of six new species. Acta Societatis Zoologicae Bohemoslovenicae 64: 153–201.

Kovařík F (2004) *Euscorpiops kubani* sp. nov. from Laos (Scorpiones, Euscorpiidae, Scorpiopinae). Acta Musei Moraviae, Scientiae biologicae (Brno) 89: 13–18.

Kovařík F (2005) Three new species of the genera *Euscorpiops* Vachon, 1980 and *Scorpiops* Peters, 1861 from Asia (Scorpiones: Euscorpiidae, Scorpiopinae). Euscorpius 27: 1–10.

Kraepelin K (1891) Revision der Skorpione. I. Die familie der Androctonidae. Jahrbuch der Hamburgischen Wissenschaftlichen Anstalten 8: 1–144.

Kraepelin K (1913) Neue Beiträge zur Systematik der Gliderspinnen. III. A. Bemerkungen zur Skorpionenfauna Indiens. Beiheft zum Jahrbuch der Hamburgischen Wissenschaftlichen Anstalten 30: 123–167.

Lourenço WR (1998) Designation of the scorpion subfamily Scorpiopsinae Kraepelin, 1905 as family Scorpiopsidae Kraepelin, 1905 (stat. nov.): its generic composition and a description of a new species of *Scorpiops* from Pakistan (Scorpiones, Scorpiopsidae). Entomologische Mitteilungen aus dem Zoologischen Museum Hamburg 12 (157): 245–254.

Pocock RI (1900) Arachnida. The fauna of British India, including Ceylon and Burma. Published under the authority of the Secretary of State for India in Council; London, 279 pp.

Sissom WD (1990) Systematics, biogeography and paleontology. In: Polis GA (Ed). The Biology of Scorpions. Stanford University Press, Stanford, 64–160.

Soleglad ME, Sissom WD (2001) Phylogeny of the family Euscorpiidae Laurie, 1869 (Scorpiones): a major revision. In: Fet V, Selden PA (Eds) Scorpions 2001. In Memoriam Gary A. Polis. British Arachnological Society, Burnham Beeches, Bucks, 25–111.

Sun D, Zhu MS (2010) One new species of scorpion belonging to the genus *Euscorpiops* Vachon, 1980 from Yunnan, China (Scorpiones: Euscorpiidae, Scorpiopinae). Zootaxa 2399: 61–68.

Thorell T (1888) Pedipalpi e Scorpioni dell'Arcipelago Malese conservati nel Museo Civico di Storia Naturale di Genova. Annali del Museo Civico di Storia Naturale di Genova 6: 327–428.

Thorell T (1893) Scorpiones exotici R. Musei Historiea Naturalis Florentini. Bollettino Della Società Entomologica Italiana 25 (4): 356–387.

Tikader BK, Bastawade DB (1983) The Fauna of India. Vol. 3. Scorpions (Scorpionida: Arachnida). Zoological Survey of India, Calcutta, 671 pp.

Qi JX, Zhu MS, Lourenço W (2005) Eight new species of the genera *Scorpiops* Peters, *Euscorpiops* Vachon, and *Chaerilus* Simon (Scorpiones: Euscorpiidae, Chaerilidae) from Tibet and Yunnan, China. Euscorpius 32: 1–40.

Prendini L (2000) Phylogeny and classification of the superfamily Scorpionoidea Latreille, 1802 (Chelicerata, Scorpiones): An exemplar approach. Cladistics 16: 1–78.

Wu HW (1936) A review of the scorpions and whip-scorpions of China. Sinensia 7: 113–127.

Vachon M (1952) Études sur les Scorpions. Institut Pasteur Algérie, Algérie, Alger, 482 pp.

Vachon M (1974) Étude des caractères utilisés pour classer les familles et les genres de Scorpions (Arachnides). 1. La trichobothriotaxie en arachnologie. Sigles trichobothriaux et types de trichobothriotaxie chez les scorpions. Bulletin du Muséum national d'Histoire naturelle, Paris, 3 sér., n, 140, Zool. 104: 857–958.

Vachon M (1980) Essai d'une classification sous-générique des Scorpions du genre *Scorpiops* Peters, 1861 (Arachnida, Scorpionida, Vaejovidae). Bulletin du Muséum national d'Histoire naturelle, Paris, 4e sér., 2 (A1): 143–160.

Zhu MS, Qi JX, Song DX (2004) A checklist of scorpions from China (Arachnida: Scorpiones). Acta Arachnologica Sinica 13: 111–118.

Zhu MS, Zhang L, Lourenço WR (2007) One new species of scorpion belonging to the genus *Euscorpiops* Vachon, 1980 from South China (Scorpiones: Euscorpiidae, Scorpiopinae). Zootaxa 1582: 19–25.